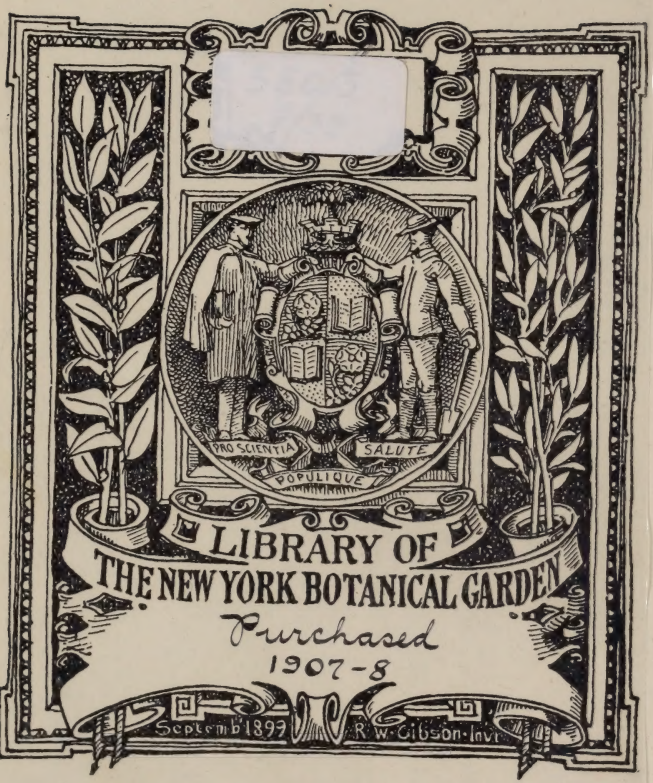
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THE

FERN BULLETIN

A Quarterly Devoted to Ferns

EDITED BY WILLARD N. CLUTE

VOLUME XV

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CONTENTS

PAGE

American Fern Society.....31, 96
Aspidium Cristatum..... 79
Aspidium Spinulosum and its Varieties..... 80
Book News.....30, 62
Boston Fern, the, and its Sports—*Willard N. Clute* 73
Brake, The Common, as Food..... 41
British Ferns, Deciduous..... 75
Check-list of the North American Fernworts—*Willard N. Clute*.....19, 45, 120
Christmas-Fern, A Bipinnatifid—*Willard N. Clute* 72
Cinnamon Fern, A Cut-leaved..... 16
Cinnamon Fern, Fail Fruiting of—*Willard N. Clute* 39
Deciduous British Ferns..... 75
Editorial 28, 60, 92, 128
Equisetum hyemale..... 82
Evergreens, Cash for—*Willard N. Clute*..... 77
Fairy Rings of Lycopodium sabinaefolium in Maine—*Alvin H. Trundy*..... 70
Fern Bulletin, Owners of Complete Files..... 63
Fern Flora of Ohio—*Lewis S. Hopkins*..... 1
Fern's Struggle for Existence in the Tropics—*Willard N. Clute*..... 34
Fern Study, Fifteen Years of—*Willard N. Clute*. 97
Fernworts, Check-list of the North American.....19, 45, 120
Filmy Fern, The Round-leaved—*Willard N. Clute* 14
Index to Recent Literature.....26, 58, 90
In Memorium..... 65
Isotes Saccharata in the Delaware River—*W. A. Poyser* 18
Lomaria Spicant, variable Sporelings of—*Amedee Hans* 33
Nomenclature, Concerning—*S. B. Parish*..... 38
Polystichum acrostichoides incisum interpreted—*E. J. Winslow*.....101

PAGE

Pteris aquilina pseudocaudata, an aberrant—*Willard N. Clute* 43
Rare Forms of Ferns.....16, 43, 71, 101
Tropical Ferns, The Ecology of Some—*E. B. Copeland* 102

PTERIDOGRAPHIA:

Asplenium Pinnatifidiem in Connecticut..... 15
Botrychium Lunaria Onondagense..... 58
Botrychium simplex, Southern Station for..... 17
Botrychiums in Sand..... 82
Boulder Fern, the, and Water..... 57
Bracken Protected by Law..... 26
Cinnamon Fern, Fragrant..... 85
Complete Sets, More..... 87
Crest-fern, Florida..... 83
Cyrtomium, Reported Find of..... 89
Cystopteris fragilis, Habitats of..... 53
Dorset Ferns, Additional..... 49
Drouth, Ferns and..... 55
Edible Ferns..... 50
Equisetum for Decorations..... 89
Fern Garden, The..... 51
Ferns and Drouth..... 55
Ferns and Lime..... 55
Ferns, Polynomial..... 84
Fertile Panicles, Three..... 49
Florida Crest-fern, Hardiness of..... 13
Fossil Ferns are Rare..... 54
Fresh Fronds, Packing..... 52
Genera and Species, Fern..... 56
Hart's-tongue, Rooting at the Tip..... 88
Lime, Ferns and..... 55
Lygodium as a Decoration..... 53
Mailing Small Ferns..... 86
Marsilia Leaves and Light..... 24
Nephrodium Boottii, a Hybrid..... 53
Nephrodium cristatum variable..... 83
Nephrodium Patens..... 89
Nephrolepis, The Tubers of..... 84
Nomenclature, Absurdity in..... 57
Onoclea Sensibilis in the South..... 50
Onoclea Sensibilis, The Forms of..... 85
Polypodium vulgare auritum..... 86
Pteris Serrulata, Range of..... 87
Resurection Fern, Reproduction of..... 25
Walking Fern, The Eared..... 86
Water Clover, The..... 44
Water, The Boulder fern and..... 57

Vol. XV No. 1

The Fern Bulletin

A Quarterly Devoted to Ferns

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The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, EDITOR

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TRICHOMANES RENIFORME

THE FERN BULLETIN

VOL. XV. JANUARY, 1907. No. 1

THE FERN FLORA OF OHIO.

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BY LEWIS S. HOPKINS.

From an ecological standpoint, Ohio represents what might be termed average conditions. The forty inches of rainfall is usually fairly well distributed, the summers are warm but not excessively so, while the winters are not unusually severe. There are no real mountains in the State, the average elevation being 760 feet above sea level. At the same time there are over forty points in the State whose elevation is over 1000 feet, the highest being Hogue's Hill, near Bellefontaine, which is 1540 feet high. The main features of relief are due to erosion and not to anticlinal or snyclinal folds. The river valleys formed by the erosive action of the streams extend north and south. The main water-shed, about 1100 feet high, extends across the State from its northeastern corner to near the middle of the western boundary. Glacial drift covers the northwestern three-fourths of the State. There are no real lakes in Ohio, yet there are numerous ponds bearing the name on the northern slope, as well as peat in various stages of formation. The soil in these regions affords ideal conditions for the raising of celery, onions, etc., and many acres are annually being reclaimed for this purpose, to the destruction of the native flora of these most interesting regions.

Generally speaking, the rock-loving ferns are more abundant in that part of the State which lies south of the fortieth parallel; the marsh-loving ferns in that part included in the St. Lawrence basin; while the wood ferns are likely to be found anywhere. It might be added also that the rock-loving ferns, owing to the nature of their

APR 19 1907

habitat, have been less disturbed by the inroads of civilization than any other group and will continue longer for the same reason.

The Fern Allies of Ohio are a very much neglected group of plants. Familiarity has bred contempt for two or three of the most common ones, while a lack of attractive features has probably caused others to be passed by for their more showy fellows. More investigation is needed in order to complete a thoroughly reliable list of the Fern Allies of Ohio. In all seventeen species are included in Dr. Kellerman's State Catalogue, but of this number, four are not referred to any locality, leaving one in doubt as to their occurrence. It is highly probable that most of them occur in greater abundance than is indicated in the following list, and also that a careful search will reveal still other species not now recorded as occurring in this State.

The student of Ohio ferns who has never visited the sandstone rocks at Dundee, Tuscarawas County, has a rich treat in store for him, and should spend at least two days in this vicinity, for it abounds in things full of interest to the general botanist as well as to the fern student.

In the summer of 1905, in the course of a two hours' exploration of a wet, hilly woodland of 12 acres in Wayne County, I found 14 species of ferns—the most I had ever seen up to this time in a single afternoon's walk—including the very rare (for Ohio at least) *Nephrodium cristatum clintonianum*. In the early part of September, 1905, in the "Garden of the Gods," three miles north of Massillon, sixteen of the commoner species were found within a radius of half a mile. Induced by and in company with some friends who are fond of outdoor life, a visit was paid to Sigrist's Rocks at Dundee on August 28th, 1906. My skepticism soon gave way to the greatest delight, for growing within half a mile of each other, were found no less than twenty species of ferns, proper, varying in number from the common polypody which covers the sandstone rocks by the thousand, to a single fruiting

specimen of the ternate grape fern, and including the *Dicksonia punctilobula* and *Phegopteris polypodioides,* both of which are not common in Ohio—in fact I had never seen either growing but once before, and at widely separated stations. This, too, is the only place I have ever seen the cinnamon fern growing high and almost dry upon rocks and apparently in a very prosperous condition, although not exposed to the direct rays of the sun.

. . . . .

The list which follows includes two species excluded from the latest catalogue published under the direction of Dr. Kellerman, chief botanist at the State University, but in each case I have collected the specimens myself and my own analysis has been verified by competent authority.

OPHIOGLOSSACEÆ.

Ophioglossum vulgatum L. Adder's Tongue. Represented in the State herbarium by specimens from eight counties in different parts of the State. I have never seen it growing, but have specimens secured from Mr. Roscoe J. Webb of Portage County. It is probably more widely distributed, but less often recognized, than some of the other ferns which are not considered so rare.

Botrychium Obliquum Muhl. Grape-fern. This species with all its different forms and intermediate varieties, is widespread in its distribution over the State, but not abundant anywhere. A single station in Miami County, from which I have collected many specimens, contains about fifty plants. I have had no trouble in transplanting it, and from my own experience, have reason to believe it reproduces from a short, thick rootstock as well as the usual way. However, this last statement needs to be verified before being accepted as final.

Botrychium lanceolatum S. G. Gmel. Lance-leaved Grape-fern. First collected by the writer in Geauga County in 1900, when a diminutive specimen was found by the roadside near Thompson. In 1904 another speci-

men was found in an open woods near Middlefield in the same county.

Botrychium Lunaria L. Moonwort. This is reported from Lake County.

Botrychium matricariæfolium A. Br. Matricary Grape-fern. Know only by specimens from Cuyahoga County. It is unquestionably one of the rarest ferns of the State. The reader unacquainted with the local geography of Ohio, would do well to note that this and the two preceding species are found in four counties only (Lake, Portage, Cuyahoga, and Geauga), either bordering on or closely adjacent to Lake Erie, in the extreme northeastern corner of the State.

Botrychium Virginianum L. Rattlesnake Fern. Common in rich woods everywhere. It could probably be found in every county in the State if one were to search for it. It varies greatly in size from diminutive plants to those over two feet high in more favored localities.

OSMUNDACEÆ.

Osmunda regalis L. Royal Fern. Abundant; found with the following species:

Osmunda cinnamomea L. Cinnamon Fern. Of great size and abundance in the small marshes and bogs which abound in the northern part of the State, but rather rare south of the fortieth parallel, owing to the lack of proper ecological conditions. The same might be said of *O. Claytoniana.*

Osmunda Claytoniana L. Clayton's Fern. My experience has been that this plant fruits most abundantly in open fields and roadside thickets, rather than in rich woods where the larger plants are usually sterile. In such places it is a beautiful plant, and often transplated to yards in the north where it thrives, and becomes fertile. I have seen open fields near Thompson, Geauga County, containing hundreds of plants of this fern.

POLYPODIACEÆ.

POLYPODIUM VULGARE L. Polypody. Not rare, but rather local in its distribution. Where it does occur, it is likely to be abundant, although two stations are known to the writer which contain fewer than fifty plants.

POLYPODIUM POLYPODIODES (L.) Gray Polypody. Rare; only two counties, Adams and Hamilton, in the extreme southwestern corner of the State, are honored by its presence. I have never collected it.

ADIANTUM PEDATUM L. Maidenhair. The one fern known by everybody everywhere, and it is as common as it is well known.

PTERIS AQUILINA L. Brake or Bracken. Abundant in northern Ohio, but rather rare in the south. It attains great size compared with other Ohio ferns, and it is no uncommon thing to find specimens over forty inches in length and width. These specimens, however, would seem diminutive by the side of those from Oregon, Maine, or the Andes. The bracken is the subject of attack by some parasite, so that good fruiting specimens are rather difficult to obtain at all times.

PELLÆA ATROPURPUREA (L.) Purple Cliff-brake. Occurs in profusion, but is local in its distribution. To see it at its best, one must visit the Niagara Limestone exposures in Highland, Green, Clark, and Miami Counties, where it literally occurs by the mile and is numbered by the tens of thousands. It is very rare in the north, being known at present only in Stark and Ottawa Counties.

WOODWARDIA VIRGINICA (L.) Virginia Chain Fern. Occurs in and around some of the small lakes in Williams, Summit, Defiance, Wayne, and Ashtabula Counties, all in the northern part of the State. It is not seen in many private herbariums.

ASPLENIUM PINNATIFIDUM Nutt. Pinnatifid Spleenwort. Not common; it has been collected in Fairfield, Hocking, Lawrence, and Logan Counties.

Asplenium ebonoides R. R. Scott. Very rare; the only authentic specimens known are those from Hocking County, in the State Herbarium.

Asplenium parvulum Mart. & Gal. Small Spleenwort. Represented by specimens collected only recently by Dr. Kellerman in Adams County (on the Ohio River), which is perhaps the most northern station known for this species.

Asplenium platyneuron (L.) Ebony Spleenwort. Fairly abundant on shaly hillsides all over the State, yet specimens cannot always be secured for the herbarium when wanted. Its former abundance is testified to by the frequent occurrence of isolated plants in localities favorable to their preservation.

Asplenium Trichomanes L. Maidenhair Spleenwort. Abundant in suitable localities. Since it is limited to limestone and sandstone formations, it is somewhat local in its occurrence.

Asplenium angustifolium Mich. Narrow-leaved spleenwort. This is to me one of our most beautiful ferns. It is not scarce and is to be found in shady, damp woods throughout the State, but does not stay long after the underbrush has been cleared out. I have had no trouble in securing plenty of fertile fronds with an occasional intermediate one, though some collectors report otherwise.

Asplenium ruta-muraria L. Wall Rue. This ranks with the rare ferns of the State. The single station known for it is in Greene County, and at the present time numbers approximately one hundred plants whose short stiff rootstocks find solid footing in the cracks and crevices of a western exposure of Niagara Limestone. No other fern with which I am acquainted is so exacting in its choice of a home. This station has been under my observation for several years, and quite a number of plants have been collected from it. Just around a corner and not over five feet from the place where strong, vigorous plants grow, not a single plant has been found on a

southern exposure of the same material and ecological conditions.

Asplenium montanum Willd. Mountain Spleenwort. This is perhaps as rare as the wall rue, being represented in the State herbarium by specimens from Summit County, while Mr. Scott Harry, from whom I obtained some excellent specimens, collected it at Graber's Rocks, Tuscarawas County.

Asplenium achrostichoides Sw. Silvery Spleenwort. This is common and to be found in almost any wet woods. Some species of insects prey upon it to such an extent that fine, whole fruiting specimens are sometimes difficult to find.

Asplenium filix-foemina (L.) Lady Fern. Of frequent occurrence and wide distribution over the entire State. It is commonly transplanted in the south and makes a beautiful and attractive fern for the yard. The varieties *ovatum, incisum, laxum, distans,* and *angustum* have all been collected by the writer.

Camptosorum rhizophyllus (L.) Walking Fern. This is always interesting to the fern student who finds it for the first time. It is widely distributed over the southern half of the State, where large limestone rocks are often fairly carpeted with it. I believe it no exaggeration to say that I have seen ten thousand plants in the course of a single day's walk in Greene County. Strong and vigorous, it curls up to withstand drought. Forking fronds are not uncommon.

Nephrodium achrostichoides (Michx.) Christmas Fern. Occurs everywhere, although more common in the north. In Ohio it is distinctively a hillside fern. Its varieties *incisum* and *crispum,* with their intermediate forms, are of frequent occurrence. The conclusion may be premature, but from observations of the same plants extending over a period of three years, I venture the assertion that the variety *incisum* is only a later form of the type as I have repeatedly found them both when the type form would be old and unfit for pressing, while the

variety would be just right. It seems almost as if the plant, desirous of insuring its propagation, rushes to maturity, the first form fertile at its apex only, and then takes its time for the later fronds fertile their entire length.

Nephrodium Noveboracense (L.) New York Fern. More abundant than indicated by State herbarium specimens, as I, alone, have found it in four other counties than those given the State catalogue. It may be found in narrow wooded valleys and wet woods of the north, but is rare in the south. When found at all, it is likely to be plentiful.

Nephrodium cristatum (L.) Crested Fern. Not rare, yet not as common as some other species of a similar habitat. It is likely to be found anywhere in swampy or wet lowland thickets.

Nephrodium cristatum Clintonianum (D. C. Eaton.) Crested Fern. First collected in 1903 in Wayne County, a few miles east of Wooster. There were fewer than ten plants at the single station found. As they were in a place likely to be cleared away at any time, I felt justified in taking up four of the smaller plants and transplanting them to the school yard at Troy, where they prospered better than many other species which grew in my little fernery there. Two of these plants were afterwards taken up and sent to the Ohio State University. Of their subsequent fate I am uninformed. The single station in Wayne County is the only place in the State where it has ever been collected so far as present records show. It fruits from four to six weeks earlier than the preceding species which may be found a short distance away.

Nephrodium Boottii (Tuckerm.) Boott's Shield-Fern. This species was collected about one mile east of Middlefield, Geauga County, June 17, 1905, in an open wet woods. A single plant was all that was seen and from it four passably good specimens were secured. This interesting fern ought to be found in other localities, for

there are many places favorable to its growth. Of the four fronds secured, one was sent to Dr. Britton, through whose courtesy Prof. Underwood confirmed my analysis of the plant; one will be sent to Columbus for the State herbarium; while the other two will be kept in the writer's private herbarium until additional specimens are secured.

Nephrodium Goldieanum (Hook.) Goldie's Fern. A magnificent plant not rare in Ohio, and yet not always easy to find, as those will testify who have searched in vain for it. It usually occurs in abundance wherever there is a station for it. I have found it in only one county—Geauga.

Nephrodium marginale (L.) Marginal Shield-fern. Plentiful everywhere on shelving wooded hillsides where it reaches its greatest perfection both as to size and characteristic green color. I have collected it in five counties.

Nephrodium spinulosum (Retz.) Spinulose Shield-fern. Fairly common in Ohio, but not so abundant as the following species which is the best known and to which the common name is most often applied.

Nephrodium spinulosum intermedium (Muhl.) Occurs in wet woods in great profusion over the entire State. Within the last five years I have examined many hundreds of plants in futile endeavor to find *Nephrodium spinulosum dilatatum* which was reported in the first State catalogue, but omitted from later ones. The two preceding forms vary greatly in size, form and manner of cutting, and are very beautiful. They are easily transplanted and thrive if given ordinary care.

Nephrodium Thelyteris (L.) Marsh Fern. This can be had in almost any swamp or marsh, in company with its favorite companions, the wild rose and the cat-tail.

Phegopteris polypodioides Fee. Long Beech-fern. Could hardly be considered rare, since it is known to occur in eight counties, yet few have seen it growing. My first and only specimens were collected in Parkman Township, Geauga County, June 18, 1905. I shall forever "asso-

ciate it mentally with the drip and splash of falling water, and the gurgle of small streams." There is no trouble in separating it from the following.

PHEGOPTERIS HEXAGONOPTERA (Michx.) Broad Beech-fern. Quite common in rich woods and thickets. A number of plants are usually found together at each station. I have often seen it growing in somewhat protected locations after the first heavy frosts had killed most of the surrounding vegetation.

PHEGOPTERIS DRYOPTERIS (L.) Oak Fern. Rather rare in Ohio as it is limited to three northern counties, Ashtabula, Lake, and Wayne. At Funk's Hollow in the latter county, the only place where I have ever seen it growing, there are quite a good many plants on a steep moss-covered hillside of sandstone where it finds a congenial companion in the shining club-moss.

CYSTOPTERIS BULBIFERA (L.) Bulblet Bladder-fern. Rather local, but found in great profusion at its various stations. It is easily transplanted and readily adapts itself to the ordinary fernery. The Niagara limestone cliffs along the upper course of the Little Miami River bear thousands of specimens of this fern, but it is only rarely met with in the northern part of the State. It also grows readily on the talus at the foot of the cliffs. It varies considerably in size, frequently reaching a length of four feet in the more favorable locations.

CYSTOPTERIS FRAGILIS (L.) Fragile Bladder-fern. Found everywhere and not a bit fragile, if I may speak from personal experience, since I have given particular attention to this fern and have collected approximately two thousand specimens, the most interesting of which, including all sorts of freaks and variations, were retained. An old unused well within the city limits of Wooster, and not over four hundred yards from the University of Wooster, has furnished me with my most interesting specimens. The variety *magnasora* Clute was found in Wayne County, July 15, 1905.

DICKSONIA PUNCTILOBULA (Michx.) Boulder Fern.

This was one of the first ferns collected by the writer, several years ago in Geauga County. Since that time he has not seen it growing anywhere. It is reported from five other counties than the one named, but is not plentiful in Ohio.

Onoclea sensibilis (L.) Sensitive Fern. Common everywhere in wet woods, marshes, thickets, and borders of woods. I have experienced no trouble in finding fertile fronds. A single specimen of the so-called variety *obtusiloba* was collected in Wayne County in 1904.

Onoclea struthiopteris (Hoff.) This enjoys the distinction of being included in the first catalogue of Ohio's flora, then excluded and included in one and the same bulletin. I have seen this species exposed for sale in the streets of Cleveland, almost by the wagon load, under the name of "southern palm fern." I have reason to believe it has been offered in the market at Springfield, but of this I am not quite certain. Near Middlefield there is a station for this plant, which contains over forty strong, vigorous plants. The yards of Wooster contain many really magnificent specimens of the ostrich fern, and I believe a careful search of all available territory would reveal its presence in Wayne County.

Woodsia obtusa (Spreng.) Obtuse Woodsia. Limited to the southern part of the State where it is fairly abundant wherever there are out-croppings of limestone. It is to be looked for in company with the bladder ferns and the purple cliff-brake. However, it differs from them in that it seems to prefer detached boulders rather than the face of the cliff for its home.

Asplenium fontanum (L.) Sometimes credited to Ohio, but at the present is not authenticated by any herbarium specimens. All told I have spent several weeks searching for this fern at Springfield, it reputed home. It is needless to say I did not find it, but then not near all of the available territory was gone over, and that by one pair of eyes only. For the present at least, it should be excluded from the list Ohio ferns.

SALVINIACÆ.

AZOLLA CAROLINIANA (Willd.) Reported from Hamilton and Lake Counties.

EQUISETACEÆ.

EQUISETUM ARVENSE (L.) Field Horsetail. Common everywhere, and in some localities is a bad weed, difficult to eradicate, owing to its long rootstock. It fruits very early, and in the popular mind there is no connection between the fertile fronds and the later appearing sterile ones.

EQUISETUM PRATENSE (Ehrb.) Thicket Horsetail. Reported from Auglaize, Erie, Clarke, and Summit Counties; probably more common.

EQUISETUM SYLVATICUM (L.) Wood Horsetail. Reported from Wood and Auglaize Counties.

EQUISETUM FLUVIATILE (L.) Swamp Horsetail. Reported from Clermont and Cuyahoga Counties.

EQUISETUM ROBUSTUM (A. Br.) Stout Scouring-rush. Reported from Cuyahoga County.

EQUISETUM HYEMALE L. Common Scouring-rush. Common throughout the entire State and an obnoxious weed in many localities.

EQUISETUM LAEVIGATUM A. Br. Smooth Scouring-rush. Reported from Erie, Cuyahoga and Summit Counties.

EQUISETUM VARIEGATUM Schlch. Variagated Equisetum. Reported from Lake County.

EQUISETUM SCIRPOIDES Mx. Sedge Equisetum. This is reported in the State Catalogue, but referred to no locality.

LYCOPODIACEÆ.

LYCOPODIUM LUCIDULUM L. Shining Club-moss. Reported from Licking, Perry and Stark Counties. I

have also collected it in Wayne County where there are several stations for it.

LYCOPODIUM INUNDATUM L. Bog Club-moss. Referred to no locality, but included in the State Catalogue. It probably will be found in the northern part of the State, as there are many suitable localities for it there.

LYCOPODIUM OBSCURUM L. Ground Pine. Reported from Ashtabula and Defiance Counties.

LYCOPODIUM ANNOTINUM L. Stiff Club-moss and LYCOPODIUM CLAVATUM L. Running-pine are reported from the State, but referred to no locality.

LYCOPODIUM COMPLANATUM L. Trailing Christmas-Green. Reported from Cuyahoga County. I have collected it at "Pewee Hollow," Wayne County, where it grows plentifully on the summits of the ridges.

SELAGINELLACEÆ.

SELAGINELLA RUPESTRIS (L.) Rock Selaginella. Reported from the State, but not referred to any station. It will probably be found and verified.

HARDINESS OF FLORIDA CREST FERN.—*Nephrodium Floridanum* is fairly hardy at Joliet. A small percentage only have been killed in the outside ground by the freezing and heaving. When well established and with a little protection it will do as well as any. It is also an excellent house fern. The fertile fronds do not fall down as with its near relative, *N. cristatum,* but remain erect and glossy until far over into the next season and the clumps increase in size rapidly. It is one of the best in cultivation whether in a pot, in a moist situation, or upon a stump pile. In the shade it is as dark in color as *N. Goldieanum,* more polished and richer in color than *N. cristatum* or *N. Braunii* in their wild state.—*James H. Ferriss. Joliet, Ill.*

THE ROUND-LEAVED FILMY FERN.

Trichomanes reniforme.

By Williard N. Clute.

The family Hymenophyllaceæ to which the filmy ferns belong, is one of the most interesting of fern families. In its ranks are to be found the very smallest ferns in the world, some of them, as in the case of our own *Trichomanes Petersii* of the southern States, so small that the mature plant, or several of them, may be concealed under one's finger. There are a few forms that occur in temperate regions, but the majority are to be found in moist places in the tropics. Given a warm region with plenty of moisture, and the filmy ferns are likely to be present in abundance. The writer well remembers taking shelter from the rain under a leaning tree trunk in the forests of Jamaica, and watching the rain-drops trickle down from no less than eleven different species of filmy ferns, while the shower continued. The cause of the great dependence of these ferns upon moisture, is that their fronds are usually but a single cell in thickness, and being unprotected by a thick epidermis, as the ferns of dry regions are, would dry out very quickly in places where the air is not constantly moist. They are thus well named filmy ferns.

There are two great genera in the filmy fern family named respectively, *Hymenophyllum* and *Trichomanes*. The members of both are very much alike in appearance. The principal distinguishing feature being found in the form of the fruiting parts. The sporangia are not found in sori on the backs of the fronds, as the ordinary ferns fruit. Instead, some of the marginal veins project from the edges of the fronds as slender bristles, and the sporangia are clustered around this. The indusium is a cup-like structure surrounding the base of the bristle, and this is often spoken of as the involucre. If the involucre is

two-lipped the specimens belong to *Hymenophyllum;* if not, they are to be referred to *Trichomanes.*

The illustration represents a curious round-leaved *Trichomanes* from New Zealand, which is remarkable for being the only species of filmy fern with fronds four cells thick. In the herbarium it is quite stiff and firm in comparison with the others of its kin. One has only to compare this illustration with the one of the round-leaved maidenhair published in this magazine for April, 1905, to see how easily nature is able to vary the species with slight changes in the fruiting parts of the frond.

In the two genena of the Hymenophyllaceæ there are no less than four hundred and fifty species, but very few of them stray far beyond tropical regions. Four species are found in the United States, and a few others reach Great Britain. On the other side of the equator some forms extend to New Zealand as we have intimated.

Asplenium pinnatifidum in Connecticut.—So far as known *Asplenium pinnatifidum* is of rare occurrence in New England; in fact its sole claim to being an inhabitant of that part of the world rests upon a single specimen from Sharon, Connecticut, reported by F. W. Kobbe. During the past summer, however, Mr. H. C. Bigelow of New Britain, Connecticut, was fortunate enough to find two specimens of this species near New Britain. This second record for New England extends the range northeastward some fifty miles. The fern was collected on the ridge of trap rock that runs parallel to the valley of the Connecticut river, and it is quite likely that further search will disclose other stations for it. The note regarding this find published in *Rhodora* in anticipation of the present note was incorrect in several particulars, possibly due to haste in getting into print.

RARE FORMS OF FERNS.—II.

A CUT-LEAVED CINNAMON FERN.

Shortly after the description of *Osmunda cinnamomea bipinnatifida* was published in the April number of this Magazine specimens of a cut-leaved cinnamon fern were received for name from Mrs. J. B. Clapp, who collected it near Barnard, Vermont. Two of the middle pinnæ are

illustrated herewith, about two-thirds natural size. This specimen is much like the form *bipinnatifida* but the cutting is somewhat sharper than in that form. It is probably more nearly related to the form *incisum*. This latter form was described in THE FERN BULLETIN, Vol. 7, page 12, as follows: "If these peculiar forms are to be termed

varieties, why may not the same peculiarity in *Osmunda cinnamomea* be entitled to the same dignity. I have found a large quantity of fronds of the last named fern very beautifully incised, as much so as any fern I ever saw. I think they may properly be labelled *O. cinnamomea incisa.*" It may be added that this form and the form *bipinnatifida* may likely be found in any deep-shaded half bog, in which the species is plentiful. Of the two, *bipinnatifida* seems the more common. It may be distinguished by its even, rounded, basal, segments and by the fact that the pinnules thus lobed are likely to be much longer than the other pinnules of the pinna. As may be seen from the illustration the form is much handsomer for cultivation than the ordinary plant. If the variation is permanent it would no doubt have a commercial value. Experiments made in transplanting it, however, have not been successful, the fronds of subsequent years reverting to the type.—*Willard N. Clute.*

Southern Station for Botrychium Simplex.—Last summer in the San Bernardino Mountains I made the discovery of a new station for *Botrychium Simplex.* I found, in a far out-of-the-way cañon, a single specimen of this fern, which I submitted to Mr. S. B. Parish, of San Bernardino, whom you probably know as a botanical authority. He says the plant has never before been seen in this extreme southwest in all his thirty years' botanical experience; a fact quite worthy of note. The plant was found at nearly 8000 feet altitude—but a few score of yards, in fact, from the spot where Mr. Parish established the first Southern California station for *Polypodium vulgare* some years ago. It grew amid precipitous rocks almost side by side with summer mountain snow banks.—*G. Ross Robertson, Mentone, Cal.*

ISOETES SACCHARATA IN THE DELAWARE RIVER.

By W. A. Poyser.

Last July we collected at Delair, New Jersey, a few miles above Camden, three species of *Isoetes,* one of which was *Isoetes Dodgei.* The remaining two were rather puzzling. We had expected to collect *Isoetes riparia,* but could not reconcile the descriptions of this latter species with the material gathered, without leaving a doubt as to the absolute correctness of the determination. Mr. Alvah A. Eaton having kindly consented to give his opinion as to their identity, I sent him a batch of living plants from two colonies. They proved to be *Isoetes riparia* and *I. Dodgei* from one and *Isoetes saccharata* from the other—all typical plants.

Isoetes saccharata grows among the tall river-shore vegetation in very shady soil. *Isoetes Dodgei* occurs sparingly with a colony of *I. riparia* extending along the stony beach about eighty paces, forming an irregular belt, averaging about five paces wide. The plants are as plentiful as grass upon a lawn, not sharing the space with other species. All the colonies about Delair are immersed at high tide and exposed at low water, at least during the summer.

Mr. Eaton having expressed a desire to have me look for possible intermediates between *Isoetes riparia* and *I. saccharata,* I sent him plants from still another colony, that appeared after a field examination, probable. The results fully justified expectations. In the lot was *Isoetes Dodgei* (a single plant), a number of *I. echinospora Braunii* and *I. riparia* and *I. saccharata.* The series of specimens collected appear to justify Mr. Eaton's suspicion that *Isoetes riparia* is a polymorphic species and includes *Isotes saccharata.* He has them under cultivation and hopes to be able to settle this question with the material now on hand.

Philadelphia, Pa.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(*Continued.*)

HYPOLEPIS Bernh.

99. **Hypolepis repens** (L.). A single plant reported from Oakland, Fla., by L. M. Underwood; also in tropical America and southward to Brazil and Peru.

LOMARIA Desv.

100. **Lomaria spicant** (L.). DEER FERN; HARD FERN. Not uncommon on rocky slopes; California to Alaska; also in Europe, northern Asia and Japan. This is as properly placed in the genus *Blechnum.—Blechnum spicant* (L.); *Struthiopteris spicant* (L.).

The form **serratum** Wollaston is reported from Oregon; **f. bipinnatum** is a twice pinnate form from Vancouver Island.

MENISCIUM Schreb.

101. **Meniscium reticulatum** (L.). Rare; in wet shades. Southern Florida; also from Mexico and the West Indies to Brazil and Peru.

NEPHRODIUM Rich.

102. **Nephrodium amplum** (H. & B.). Rare; in moist shades. Southern Florida; also in the West Indies and south to Ecuador. — *Dryopteris ampla* (H. & B.).

103. **Nephrodium Boottii** (Tuckerm.). Not uncommon; in wet shades. Nova Scotia, Ontario and Minnesota to Virginia. Often regarded

as a hybrid between *N. spinulosum* and *N. cristatum*. Forma **multiflorum** Gilbert is a larger, more heavily fruited form occurring with the type.—*Dryopteris Boottii* (Tuckerm.); *Aspidium Boottii* Tuckerm.

104. **Nephrodium conterminum strigosum** (Fee). Rare; in woods. Ft. Meade, Florida. The type is common in the West Indies.—*Dryopteris contermina strigosa* (Fee); *Aspidium conterminum strigosum* D. C. Eaton.

105. **Nephrodium cristatum** (L.). Crested Fern. Common; in swamps, especially in shade. Newfoundland to Virginia, Arkansas, Nebraska, Idaho and the Northwest Territory; also in central and northern Europe and western Siberia.—*Dryopteris cristata* (L.); *Aspidium cristatum* (L.).

The form **marginale** Dav. is reported from New England and New York; **f. Lancastriense** (Spreng.) from the same region has the lobes of the pinnæ shorter and approaching triangular. Two hybrid forms are credited to this species—*N. cristatum* × *marginale* Dav. from New England, New York and New Jersey, and *N. cristatum* × *spinulosum* (Milde), the latter better known in America as *N. Boottii*.

106. **Nephrodium cristatum Clintonianum** (D. C. Eaton). Somewhat rare; in moist shades. Maine and Ontario to Wisconsin and Virginia. A much larger form than the type and found with it.—*Dryopteris cristata Clintoniana* (D. C. Eaton); *Aspidium cristatum Clintonianum* (D. C. Eaton).

107. **Nephrodium Filix-mas** (L.). Male Fern. Somewhat rare; in woodlands. Newfoundland, Nova Scotia and Alaska to Vermont, Michigan, South

Dakota, Arizona and California; also in elevated regions nearly throughout the world. The form **incisum** Mett. is an incised form from Colorado and Ontario.—*Dryopteris Filix-mas* (L.); *Aspidium Filix-mas* (L.).

108. **Nephrodium Floridanum** Hook. Florida Crested Fern. Not uncommon; in wet shades. Florida, southern Georgia and along the Gulf coast to Texas.—*Dryopteris Floridana* (Hook.); *Aspidium Floridanum* (Hook.).

109. **Nephrodium fragrans** (L.). Fragrant Fern. Rare; on dryish rocks. Maine to New York, Wisconsin and far northward; also in Greenland, northern Europe and Asia, Japan and the Caucasus. The form **aquilonare** (*Dryopteris aquilonaris* Maxon) is a large fruited form from Alaska.—*Dryopteris fragrans* (L.); *Aspidium fragrans* (L.).

110. **Nephrodium Goldieanum** (Hook.). Goldie's Fern. Not common; in wet woodlands. Canada to North Carolina, Tennessee and Iowa. The form **celsum** (*Dryopteris Goldieana celsa* Palmer) with smaller fronds is reported from the Dismal Swamp, Virginia.—*Dryopteris Goldieana* (Hook.); *Aspidium Goldieanum* Hook.

111. **Nephrodium marginale** (L.). Marginal Shield Fern; Wood Fern. Common or abundant; in rocky woodlands. Nova Scotia to Georgia, Alabama, Indian Territory and British Columbia.—*Dryopteris marginalis* (L.); *Aspidium marginale* (L.).

The forms **elegans** Robinson, **Traillae** Lawson and **tripinnatifidum** Clute are ecological forms found with the type.

112. **Nephrodium molle** Desv. Rare; in moist wood

lands. Florida, Georgia and Alabama; also widely distributed in the tropics. The earliest specific name of this species is *parasiticum*, but *molle* has the sanction of universal usage.

113. **Nephrodium Nevadense** (D. C. Eaton). Not common; in wet meadows. California and Oregon. The name of **Nephrodium Oreganum** (*Dryopteris Oregana* C. Chr.) has recently been given to this species.—*Dryopteris Nevadensis* (D. C. Eaton); *Aspidium Nevadense* D. C. Eaton.

114. **Nephrodium noveboracense** (L.). New York Fern. Abundant; in dryish woodlands. Newfoundland to Georgia, Arkansas and Minnesota. The form **suavolens** (D. C. Eaton) is an unusually fragrant form reported from New York. —*Dryopteris noveboracensis* (L.); *Aspidium noveboracense* (L.).

114. **Nephrodium oreopteris** (Ehrh.). Heath Fern. Rare; in meadows. Washington to Alaska; also in Europe, Madeira and Japan.—*Dryopteris oreopteris* (Ehrh.); *Dryopteris Montana* (Vogl.); *Aspidium oreopteris* (Ehrh.).

115. **Nephrodium patens** (Sw.). Common; in partial shade. South Carolina and the Gulf States to California; also in the West Indies and nearly around the world in the tropics. Forma **glandulosum** (*N. patens glandulosa* A. A. Eaton) is a glandular pubescent form found with the type.—*Dryopteris patens* (Sw); *Aspidium patens* Sw.

116. **Nephrodium patulum** (Sw.). Rare. Huachuca Mts., Arizona; also in the American tropics — *Dryopteris patula* (Sw.); *Aspidium patulum* Sw.

117. **Nephrodium reptans** (Gmel.). Rare; on moist sunny banks. Southern Florida; also in the

West Indies and southward to Brazil. This species is as well placed in the genus *Phegopteris.*—*Dryopteris reptans* (Gmel.); *Aspidium reptans* (Gmel.); *Phegopteris reptans* (Gmel.).

118. **Nephrodium rigidum argutum** (Kaulf.). Not common. Arizona and California to Alaska, mostly near the coast. The type is found from Great Britain to the Mediterranean region.—*Dryopteris rigida arguta* (Kaulf.); *Aspidium rigidum argutum* (Kaulf.).

119. **Nephrodium setigerum** (Bl.). Rare; in swampy woods. Southern Florida; also throughout the tropics.—*Dryopteris setigera* (Bl.).

120. **Nephrodium simulatum** Dav. Rare; in shaded bogs. Maine to New York and Maryland.—*Dryopteris simulata* Dav.; *Aspidium simulatum* Dav.

121. **Nephrodium spinulosum** (Mull.). Spinulose Wood Fern. Common; in rocky woodlands, especially if moist. Newfoundland to Virginia, Kentucky, Nebraska, Washington and Alaska; also in Europe and Asia.—*Dryopteris spinulosa* (Mull.); *Aspidium spinulosum* (Mull.).

The form **concordianum** Dav. is a finely divided form possibly referred to the sub-species *intermedium;* **f. fructuosum** Gilbert is a heavily fruited form from New York and New England, also referred to the sub-species; **f. Pittsfordense** is an ecological form from New York and New England.

122. **Nephrodium spinulosum intermedium** (Muhl.). Common Wood Fern. Abundant; in moist, usually rocky, woods. The common form within the limits given for the type.—*Dryopteris spinulosa intermedia* (Muhl.); *Aspidium spinulosum intermedium* (Muhl.).

123. **Nephrodium spinulosum dilatatum** (Hoffm.) Broad Wood Fern. Tolerably common; in rocky soil. An upland or mountain form found at sea-level in the far north, but limited to the mountain tops in the southern part of its range. —*Dryopteris spinulosa dilatata* (Hoffm.); *Aspidium spinulosum dilatatum* (Hoffm.)

124. **Nephrodium stipulare** (Willd.). Rare. Southern Florida. Regarded by many as a form of *N. patens* and more properly named **Nephrodium patens stipulare.** Has the same range as *N. patens.—Dryopteris stipularis* (Willd.).

125. **Nephrodium thelypteris** (L.). Marsh Fern. Abundant; in swamps and wet woods. North America east of the Rocky Mountains in suitable situations; also Europe, Asia, Africa and Australia. The form **Pufferae** A. A. Eaton is a forking form from Massachusetts.—*Dryopteris thelypteris* (L.); *Aspidium thelypteris* (L.).

126. **Nephrodium unitum glabrum** (Mett.). Not rare; in open swamps. Florida and Texas; also in the West Indies and nearly throughout the world in the tropics. This has recently been named *Dryopteris gongylodes* (Schkuhr), but is more properly **Nephrodium gongylodes** (Schkuhr).—*Dryopteris unita glabra* (Mett.); *Aspidium unitum glabrum* (Mett.).

PTERIDOGRAPHIA

Marsilia Leaves and Light.—The curious fact that *Marsilia,* like the clover and oxalis, closes its leaves at night, has long been known, but Robert F. Griggs has recently noted what appears to be a new motion of the leaves to enable them to face the sun. Thus far the habit has been noticed in but one species, *M. vestita,* but it is

likely that other species may be found to act in the same way. Acording to the writer quoted, the leaves at evening squarely face the West, while shortly after sunrise they will be found to face the East. The movement seems to be produced by the petiolules of the individual leaflets, rather than by the petiole of the leaf. The motion which causes the closing of the leaves at night is also located in the petiolules. One striking difference between the night position of marsilia and oxalis leaves is that in the former the leaflets are erect and in the latter the leaflets droop. The explanation for this seems to be a physiological one. In the oxalis the stomata or openings through the epidermis are mostly on the under surface, and the drooping position of the leaflets protects them through the night. The stomata of marsilia, on the other hand, are mostly on the upper surface, and the leaflets naturally bring their upper surfaces together in the night position.

Reproduction of Resurrection Fern.—One of the distinguishing marks of the group of *Selaginellas* to which the resurrection fern (*Selaginella lepidophylla*) belongs is the fact that it produces roots from the base of the fronds only. In most *Selaginellas* the fronds root from any part that happens to come in contact with the soil. But while the resurrection fern remains true to this principle when intact it readily casts it aside when injured for if bits of the fronds are broken off and fall in a suitable place, they at once take root as other *Selaginellas* normally do, and soon form new plants. The resurrection fern takes its name from its habit of drying up when moisture is scarce and reviving when rains come again. During drouths it becomes very dry and brittle and is then likely to be more or less shattered by the passing of animals or the force of the wind. Whether the pieces thus broken from the fronds later revive and re-

produce the plant as those broken from the fronds in the greenhouse do, is not yet known. Readers in the region where this plant grows would do a service to science by investigating.

Bracken Protected by Law.—In America the bracken (*Pteris aquilina*) receives scant attention from the land-owner, who probably never thinks of it unless he is devising a way of eradicating it from his fields. In England, however, the case is different, as indicated by the following communication recently published in *Gardening World:* "I have read with considerable surprise a letter in your issue to-day on the subject of utilizing the young shoots of bracken as food. Your correspondent does not mention the locality in which she resides, which may differ materially from others, but here in Banstead, and for many miles around, the young bracken shoots are protected by very stringent laws, inflicting a heavy fine on any person cutting or mutilating the bracken before notice allowing them to do so is issued. This generally appears about the middle of September. The bracken is then dry and of a beautiful golden brown and then any person can cut any quantity he pleases." The usual fine is $25.00 and costs. The correspondent does not indicate the uses to which the bracken is put, but it is probably used in packing vegetables and protecting tender plants outdoors, much as straw is used in America.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omissions from this list.

Bissell, C. H. *A New Station for Asplenium pinnatifidum.* Rhodora. D. 1906.—Second finding of this species in New England.

Clute, W. N. *A Check-list of the North American Fernworts.* Fern Bulletin. O. 1906.—A continuation. tion.

CLUTE, W. N. *Rare Forms of Ferns.—I. A. Round-leaved Royal Fern,* illust. Fern Bulletin. O. 1906.—A new form from Vermont named *orbiculata.*

CLUTE, W. N. *The Genus Oleandra,* illust. Fern Bulletin. O. 1906.

DOWELL, P. *Observations on the Occurence of Boott's Fern.* Torreya. O. 1906.

EATON, A. A. *Pteridophytes Observed During Three Excursions into Southern Florida.* Torrey Bulletin, 1906.

FELLOWS, D. W. *The Fern Flora of Maine.* Fern Bulletin. O. 1906.

FERRISS, J. H. *Cause of Rusted Fronds.* Fern Bulletin. O. 1906.

FERRISS, J. H. *On Cultivating Our Ferns.* Fern Bulletin. O. 1906.—Note on the behavior of various rare species in cultivation.

GILBERT, B. D. *Polypodium vulgare var. alato-multifidum.* Fern Bulletin. O. 1906.—Description of a new variety from Mauch Chunk, Pa.

GRIGGS, R. F. *A Diurnal Rotation in the Leaves of Marsilia.* Ohio Naturalist. Je. 1906.—Records the rotation of the leaflet in *M. vestita* in order to face the sun.

HANS, A. *Acrostichum and Platycerium,* illust. Horticulture. Ap. 14, 1906.

HANS, A. *Filmy Ferns,* illust. Horticulture. Je. 10, 1906.

NEGLEY, H. H. *Where Florida Ferns Grow.* Fern Bulletin. O. 1906.

PALMER, T. C. *Asplenium ebenoides in Chester Valley, Pa.* Fern Bulletin. O. 1906.—Record of its occurrence in Chester County.

PUFFER, MRS. J. J. *The Rusty Woodsia in Cultivation.* Fern Bulletin. O. 1906.

SQUIRES, W. A. *A New Station for Selaginella Douglasii.* Fern Bulletin. O. 1906.—First report of this species from Idaho.

EDITORIAL.

The delay in this issue is due to the fact that the application for the transfer of our mailing permit from Binghamton, N. Y. to Joliet, Ill., has been pending for more than three months. This seems to be the last obstacle to our appearing on time and in future we expect to issue the numbers promptly. A great part of the April issue is ready as this is written. Copy intended for that issue should be sent at once.

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It would doubtless be impossible for any body of scientists to make a set of rules for naming plants that would be acceptable to everybody else. The Vienna Botanical Congress made several rules that will likely find acceptance, but there were occasional outcrops of assininity that ought to be attended to at the earliest possible moment. After all this howl about priority of specific names, it is surely a delectable sight to find these eminent scientists solemnly agreeing that what is sauce for the botanical goose is *not* sauce for the gander. By the Vienna rules, we are still to have priority in specific names, but in varietal names, never! Take the case of *Isoetes Canadensis.* The earliest valid name given this particular quillwort is *Isoetes riparia Canadensis.* When it was later regarded as a species distinct from *I. riparia,* it was properly described as *I. Canadensis.* But while its position was still in question, Eaton described plants as *I. Dodgei,* and now by the new rules, we are asked to forget that the plant's real name is *Canadensis* and take up with *Dodgei* again because " species and not varieties are the units of classification." Can anyone believe that this idiotic rule was not made in the interests of a few botanists who rely upon its use to get their names into print? If American botanists want to earn a reputation for wisdom, they should promptly repudiate such nonsense.

Was it not Henry Ward Beecher who said that if a man owned a fine diamond with a flaw in it so small as to be perceived by nobody else, yet he would not thoroughly enjoy its possession because of the flaw that he knew was there? Anyway, none of us want possessions with flaws in them if it can be helped, and most of us are willing when we can to remove the flaws from the possessions of others when it does not cost us too much. The opportunity to be benevolent in this way we now offer to our readers, for we know of three sets of THE FERN BULLETIN, each of which lacks but a single number to be flawless, and which might easily be made complete if the holders of these numbers will only part with them. The set of Mr. Chas. W. Jenks, Bedford, Mass., lacks No. 3 of the first volume, Miss Annie Morrill Smith, 78 Orange St., Brooklyn, N. Y., lacks No. 1 of volume 4, and Mr. B. D. Gilbert lacks No. 1 of volume 4. The owners of these sets will gladly pay a good price for these numbers, but if your own set is complete, do not break it, for a full set of FERN BULLETIN is so rare that its value is increasing very rapidly. And we shall never impair it by reprinting the early numbers. There are or were, three hundred copies of each of these early numbers about, and it is not too much to hope that some of them may yet come on the market. With many, the case may be as we found it with a subscriber for the early numbers who finally dropped his subscription. Thinking he might be willing to part with the numbers, we made a cash offer for them and received the reply that he had a full set, but would not sell them to anybody. In addition to the numbers wanted which we have noted above, Prof. W. A. Setchell, of the University of California, Berkeley, California, wants Vol. 5, No. 1, and many of the earlier numbers, for which he is willing to pay a liberal price, and Prof. George F. Atkinson, Cornell University, Ithaca, N. Y., needs many of the numbers previous to Vol. 5. Two other wants in this line are to be noted among the advertisements. The trouble is that when those first small numbers appeared, nobody thought THE FERN

BULLETIN would live to grow up, and they were, in consequence, neglected. Some of those three-cent numbers are now worth a dollar or even more! And yet, when we saw those last full sets disappearing, we tried to get people to buy before it was too late. We are now doing the same thing with the few remaining sets containing Vol. 6. We have only to wait a year or so longer to see these in as great demand as the earlier numbers now are. The time to invest is now.

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We recently had cause to appreciate the truth of the old adage, that it is better to be born lucky than handsome, and as the circumstance is of interest to fern students, we purpose mentioning it. The first book devoted to American ferns was Williamson's "Ferns of Kentucky," issued in 1878 and, of course, out of print for many years. Single copies when they were obtainable, which was not often, sold for $5.00 each. The editor of this magazine has long wanted a copy, but even the second-hand dealers could not locate one. Several who listed the book had just sold it when we ordered it. When a new catalogue appeared in 1905 with the book listed, we did not write for it, being sure of disappointment again, but when a second edition of the catalogue appeared a year later with the book still in it, we took the chance, and much to our surprise got the book, which is apparently a fine copy of the first edition. And the cost was just $3.50. The editor knows of a dozen or more fern students that would have jumped at the chance to get that book at twice the price we paid, but as we said in the beginning, it is better to be born lucky than handsome.

BOOK NEWS.

Three different collecting trips have been made to Southern Florida by Mr. A. A. Eaton, in the course of which a large number of ferns new to the United States were collected. These trips and the ferns collected have

been recently described in *Torrey Bulletin,* and subsequently reprinted as contributions from the Ames Botanical Laboratory No. 4. The title is " Pteridophytes Observed During Three Excusions into Southern Florida." The new species recorded and not previously noted in this journal are *Polypodium costatum, Nephrodium setigerum* and *N. stipulare.* The broad form of *Polypodium phyllitidis* is given specific rank as *Campyloneuron latum,* a glandular form of *Nephrodium patens* is named *glandulosum,* and a lobed form of *Acrostichum lomarioides* is called *lobatum. "Tectaria Amesiana,"* a form of the variable *Aspidium trifoliatum* is named, and its hybrid origin suggested, the fact that it may be an intergrading form between two extremes apparently overlooked. The *Selaginella* previously identified as *S. Caribensis,* is now believed to be *S. rhodospora.* The account is an excellent one and will do much to assist other collectors in locating and identifying the ferns of our sub-tropical regions. It is with regret, however, that we note several imperfections in the work, such as the adoption of *Dryopteris* for *Nephrodium,* and the segregation of forms as species. The proof-reading also has been most slovenly done. *Asplenium Biscaynianum* has been described as if it were new, and *Meniscium reticulatum* is reported as new to the flora of the United States, when it was reported from Florida in The Fern Bulletin some months before Mr. Eaton first set foot upon Florida soil. Who the first person was to report the fern from the United States is not of much moment, but since this is the second time this erroneous statement has been made in *Torrey Bulletin,* it may be just as well to have the statement again denied.

AMERICAN FERN SOCIETY

The annual dues to the Society are now due. Members are requested to note that by paying their dues promptly, the officers will be enabled to plan the year's work to much better advantage and thus all will be

benefited. Do not wait for a notice from the treasurer. Should any member contemplate resigning from the Society, he should send such resignation to the treasurer and not to the publishers of THE FERN BULLETIN. The magazine is sent to each member by the Society, and members who resign are expected to pay for any copies received during the time between their resignation and the time paid for by their dues.

Mr. H. E. Ransier, who acted as judge in the recent election, reports the following officers elected for 1907: President, J. H. Ferriss, Joliet, Ill; vice-pesident, Dr. D. W. Fellows, Portland, Maine; secretary, Willard N. Clute, Joliet, Ill.; treasurer, Miss Nellie Mirick, Oneida, N. Y. A full account of the election will appear in the Annual Report, which will be issued much earlier in the year than usual.

The following persons have recently joined the Society: Miss Frances H. Newton, Ooltewah, Tenn.; Mrs. Alida Kimbell, 410 Church St., Adams, Mass.; Mrs. C. A. Pearson, 45 Suffolk St., Holyoke, Mass.; Mrs. Chas. E. Young, 1706 Oregon Ave., N. W., Washington, D. C.; Miss Ella S. Ruland, Trudeau, N. Y.; Mr. Louis Axt, 116 Richmond Ave., Port Richmond, N. Y.; Mr. Rett E. Olmstead, Decorah, Iowa. We are glad to add their names to our rolls.

In order that the new list of members in the Annual Report may be up-to-date, we request all who have recently changed their place of residence to notify the secretary or treasurer at once, if they have not already done so. The new list will contain the names of those who have paid dues since January 1, 1906, only. Although dropping all who have resigned during the year, we expect to still have more than one hundred and fifty members.

Do not forget the invitations to membership that the officers of the Society are glad to send to all who are interested in ferns, if you will send the addresses. If you are pleased with membership in the Society, pass it along to your friends.

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These works scarcely need description. A folder describing them will be sent, however, upon application.

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Vol. XV No. 1

The Fern Bulletin

A Quarterly Devoted to Ferns

April

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1907

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, EDITOR

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FORMS OF LOMARIA SPICANT

THE FERN BULLETIN

VOL. XV APRIL, 1907. No. 2

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VARIABLE SPORELINGS OF LOMARIA SPICANT

By AMEDEE HANS.

If raising ferns from spores to produce abnormal or hybrid forms is surrounded with much disappointment, sometimes very curious results are obtained which repay for the trouble and persistent labor. While it is not the habit of THE FERN BULLETIN to care much about abnormalities, it may be of interest to its readers to hear something about what can be obtained by sporelings from abnormal forms of ferns.

Lomaria (or *Blechnum*) *Spicant* is found in nature growing in cool and damp situations and is very hard to grow out of doors in the Eastern States and especially near the seashore, and in such situations seldom makes fertile fronds. One form which has often been found in England and is known there under the name of *L. s. contractum* (II.) grew a little fertile frond in our collection. From the spores we raised 65 plants. Among them the type is represented by only a few plants and there are many varied forms. The form *contractum* dominates with a tendency to gradually decline in the length of the pinnæ, shortening to the English form *lineare,* going through several forms of broad or narrow *concinnum* of the same origin (IV.). A few are contracted at the top as well as the base of the frond (III.) and could nearly be called *caudatum* (IV.), and some, the most curious of all since there were no spores from any other form of *Lomaria* present, are bi- to multi-

SEP 10 1907

furcate at the tip with shorter or longer narrow pinnæ resembling the English form *multifurcatum* (VI.). One of these *concinnum* forms has fertile fronds that are not different from the others. The sori are in short strips on each side of the rachis, one on each little pinnæ, while in the English form the pinnæ of the fertile frond are contracted around the rib of the frond. I have raised many abnormal forms from spores but never have had such a percentage of variations from so few plants.

I have also some plants raised from spores of Mr. Clute's *Polystichum acrostichoides recurvatum* and some *P. acrostichum X P. angulare* forms which I expect to have characterized this season and will publish the results later.

The interest in growing hardy fern species and forms in out-of-door ferneries is taking greater hold every day. There is no doubt that there are many abnormal forms of ferns to be found in the United States, and it is a pity that they are passed by as of little worth or simply preserved in herbariums and that nobody has a chance to handle them as living plants and to propagate them for the benefit of the lover and cultivator of these most interesting plants.

Stamford, Conn.

Explanation of Plate.—I. *Lomaria spicant* (type). II. L. S. *contractum* (the spore-bearer). III. A form. IV. Three forms from English *concinnum to lineare*. V. A form. VI. Furcate forms.

THE FERN'S STRUGGLE FOR EXISTENCE IN THE TROPICS.

By Willard N. Clute.

In the Tropics, where the conditions for the existence of fern life are most favorable, fern species are greatly multiplied and the struggle for existence is waged with greater fierceness than it is among the denizens of our own fields and woods. The great number of species as

well as individuals makes it more difficult for a species to flourish than in a section where the stress is less. The young fern finds that the ground is literally all taken with no signs of "standing room only" to be seen. It must, therefore, find a foothold elsewhere or perish. Thus it happens that many respectable fern families have been obliged to take to the "upper story of the woods" for refuge.

It is interesting to note the ways in which various species have attempted to secure advantages not possessed by their neighbors. The lack of space for all on the ground has resulted in numerous curious forms being evolved. In some parts the trees are ferns, the climbing vines are ferns, the thorns that pierce and the brambles that scratch are ferns, the epiphytes are ferns, and the very moss on the trunks seem turned to ferns.

With the exception of some mountain tops covered with *Dicksonia* in Eastern Pennsylvania, I do not remember any such vast areas covered with a single fern as I saw in Jamaica. The bracken and various species of *Gleichenia* claim whole hillsides for their own and grow in perfect thickets. This, I hasten to add, is the exception and not the rule. These two species live in localities so dry that no other species want them—at least no other species that are strong enough to take them—but in the forest one is at once impressed with the large number of species in proportion to the number of individuals. I believe that in a three-mile walk in the vicinity of Morce's Gap I could collect nearly a hundred species without going out of the path more than six feet. Nature has filled up the forest as a man would fill up a trench with gravel—using all sizes. Just as the small stones fill the chinks between the larger ones, so do the small ferns find an existence upon and between their larger relatives.

When we speak of the climbing fern in the Northern States, we have a very definite species in mind, but not so in the Tropics. It is true that the *Lygodiums*, faithful

to family tradition, are climbers still, often reaching heights of thirty feet or more, but there are other genera, such as *Davallia, Blechnum, Hypolepis, Polypodium, Acrostichum* and others that have climbing species, the hope that actuates them all being that by this means they will be able to get up in the world and obtain light and air. Some of these merely trail over bushes and trees, having hooked prickles upon the rachis to assist in holding, but nevertheless often reaching considerable heights and forming impassable thickets. Others are true twiners and, though born on the earth, soon scramble up to the top of its shelter. One *Acrostichum* with brown, scaly rootstock as thick as one's thumb, sends it straight up the trunks to heights of twenty feet or more precisely as our poison ivy does. Then it sends out its great fronds a yard across.

This hints at the possible origin of the tree ferns, for if the trunk were but a little thicker and inclined to stand upon its own resources, we should have a tree fern. The tree-ferns proper are frequently as tall as small trees with magnificent crowns of fronds. To get a good idea of what a tree-fern is like, take a pole, perch a big plant of the ostrich fern at top, wrap the pole thickly with barbed wire and small rootlets and you have it. There is no climbing fern trees unless one is insensible to thorns an inch long; and after one has once slipped in the forest and stayed himself by clutching at a tree-fern's trunk he will resolve to fall a long way in the future before trying to stop a second time in that way.

Climbing other trees for ferns, however, is quite the thing. I have a lively recollection of balancing upon a slender branch and trying to reach some specimens of *Polypodium gramineum* that were sitting in a row on a limb fully twenty feet from the ground. Many grow at greater heights and quite out of reach. In regions where a daily bath in the clouds keeps their rootstocks and roots moist, numerous species escape the crush below

by this means of living. In fact, without stopping to count I am inclined to say that as many species live above the earth as upon it. The tiny, filmy ferns, of the genera *Trichomanes* and *Hymenophyllum* are sometimes called brothers to the mosses; and in Jamaica they really deserve the title, crowding the mosses so much for room on all the moist trunks that in sort of revenge some species of mosses find a home on their fronds. The filmies also grow on wet rocks, old logs, and other places where their stronger competitors among the ferns can find no foothold.

But the struggle for existence has produced other types, among them—

"Those who fight and run away."

Apparently not liking the struggle, or perhaps getting the worst of it, they have taken to locations where the others dare not follow them. The hard, sunbaked, exposed hillsides, upon which rain often does not fall for months, has its own fern flora, albeit much scantier than in more favored regions. The ordinary fern leaf could not endure, unprotected, the steady downpour of heat, day after day, to which these are subjected. The dry ground species have, accordingly, various devices to prevent complete dessication. The species of *Gymnogramma*, many of which frequent such places, have the underside of the frond thickly powdered with farina of various colors which give them the name of silver and gold ferns. This farina is of a waterproof nature and effectually conserves such water as the plants are able to suck up from the soil. One species, *G. rufa*, lacks the powdery covering but is thickly clothed with brown hairs which answer the same purpose. To sight and touch, the frond appears as if it might have been cut out of greenish-brown velvet. Of similar appearance are the fronds of *Asplenium pumilum* and *Hemionitis palmata* to be found with it.

The *Notholænas*, most of them, have both hair and

powder on their fronds, but even this seems not enough and the fronds curl tightly up in dry weather. The little resurrection fern, *Polypodium incanum,* also grows in such places although it abounds in localities where there is more moisture. It grows both upon trunks and limbs of trees and upon bare rocks, but at the first sign of dry weather, it goes into a comatose condition, wrapping its scale-covered fronds around it, and so waits for rain.

CONCERNING NOMENCLATURE.

By S. B. Parish.

The editor of The Fern Bulletin indulges, in the January number, in condemnation, a trifle over vigorous, of the 53rd article of the code of nomenclature set forth by the recent Vienna Botanical Congress. Certainly it is annoying that this rule makes it necessary to exchange the familiar name of a certain quillwort for a neglected one. Yet it must be remembered that a contrary rule has occasioned some of the most confusing substitutions with which the nomenclature of the spermatophytes has in recent years been afflicted.

The fact is that systematists long exercised a liberty, sanctioned by custom, of disregarding varietal names when raising plants to specific rank. It was not a commendable practice, and the Vienna code recommends its discontinuance. Nevertheless, many names thus given were established and well known. Now there are not a few botanists who have never learned what nature teaches, that exceptions are the most natural things in the world. To them anything but the most rigid and searching application of the law of priority is an unendurable sacrilege. Yet the logical outcome of this doctrine is pre-Linnæanism, and those who make one fundamental exception to strict priority, by assenting to an initial date, would seem to be estopped from objecting to other exceptions.

The editor well says that "it is impossible for any body of scientists to make a set of rules that would be acceptable to everybody." Quite impossible, indeed; every attempt has demonstrated it. Yet we must have rules. The editor recommends American botanists to "repudiate such nonsense"; that is, I take it, for each to repudiate any law that appears to him objectionable. That is anarchy. Another course is for the Botanical Clubs, or similar associations, in different countries to formulate codes independently—that is provincialism. On the other hand, we may accept a code set forth by a body wherein the botanists of the whole world are, or may be, represented. Only in this way can we hope to obtain a catholic system of nomenclature. Individually we are certain to find in it something not in accordance with our ideas. Yet let us accept it, comforting ourselves with the thought that the laws of botanical nomenclature are not unlike those of the Medes and Persians, and that we may be able to bring future congresses to our wiser way of thinking.

San Bernardino, Calif.

FALL FRUITING OF THE CINNAMON FERN

By Willard N. Clute.

Although the cinnamon fern (*Osmunda cinnamomea*) is one of our most abundant species, it is quite apparent that we do not know all about it. It has an interesting trait of fruiting in the autumn in the southern States, and as yet no explanation of this peculiar habit has been given. That it normally fruits in spring there can be little doubt. In southern Louisiana I have thus found it in March, and Mr. W. C. Dukes writes me that in the vicinity of Mobile, Ala., he finds it in full fruit by the last of February, and occasionally some fronds by the middle of that month. In the same line the observations of Mr. W. C. Steele for Florida (Fern Bull. 10:19, 1902) indicate that the plant fruits there in spring. It

is among the earliest of our ferns to fruit, and in its farthest southern haunts begins to grow shortly after the new year begins. In February, 1900, I collected it in fruit near Guava Ridge in the Island of Jamaica at an altitude of about 3500 feet. The difference in altitude between this station, which, by the way, is the only one in Jamaica, and the Florida station would equalize the difference in latitude between the two. Thus the fruiting impulse may be said to begin in the West Indies and the Gulf Coast in February, passing over the southern States during March, reaching the northern States late in April and going on into Canada in May.

The second fruiting season appears rarely, if ever, to reach very far north. Mr. Steele has noted it in Florida, and in a recent publication (*Torrey Bulletin* 33:462, 1906) Mr. A. A. Eaton says (doubtless incorrectly) that "Its common time of fruiting appears to be early November, as it was in full fruit in the middle of the State at that date, and bore no indication of fruit in March, save in the case of one plant." Mr. W. C. Dukes found them fruiting about Mobile, Ala., at least three weeks earlier. He, too, found the fruiting general, and says, "I have run across colonies where scarcely any failed to develop a fertile frond. In one place I counted over fifty plants fruiting, but noticed that the fronds were not so robust as those found in spring and not as tall."

As to the cause of the fall fruiting the suggestion made by Mr. Dukes seems to offer the best explanation. He observes that the fall fruiting seems to be most prevalent in those years when summer extends far into autumn. The rains that follow form a second spring-like season, beguiling the ferns to fruit. It would be interesting to know just how general the fall fruiting of this species is, and how far it extends northward. Do the ferns fruit every year in autumn? Do the same ferns fruit again in spring? Do all, or nearly all, the ferns fruit in autumn? Are there more fruiting fronds produced in autumn than in spring? If our readers can give answers to any of these questions, we shall be glad to have them.

THE COMMON BRAKE AS A FOOD.

Almost everyone knows the common brake on bracken, (*Pteridium aquilinum*), found in woods throughout the greater part of the world. Excepting possibly Australia, it is in Western Oregon, Washington and British Columbia that it reaches its highest development. In this American area it is not only the most common fern, but the largest as well. In the damp woods it grows up through the evergreen shrubbery of salal, Oregon grape, and huckleberry so densely as to make the woods almost impassable. In the drier regions it reaches a height of three to eight feet, and in hollows where the ground is specially rich it reaches a height of fourteen feet. Occasionally there are four or five to the square foot, but when they are so dense as this, they interfere with each other and do not reach the maximum growth. The tallest are in woods where there is shade, for this makes stems and leaf-stalks grow longer. In cleared fields, however, they come up as densely as in woods, but rarely reach a height of over six feet, usually two to four. In new lands they are bad weeds, coming up year after year. The farmer considers them a pest since they are tough and hard to destroy; and the horizontal, subterranean stems, which are an inch or less in diameter, and as much as ten feet long, are hard to cut. The large amount of starch found in the stems produces numerous shoots and is their source of supply during their rapid growth.

Like all common ferns (Filicales), the leaves of this fern, when they appear above ground, are rolled up circinately, like a very much inverted capital J. The food in the subterranean stems causes such rapid growth that in the shade they reach a height of two to four feet before they unroll the leafy portion to any considerable

extent. In tenderness and thickness these leafy-shoots are very like asparagus. Tender as these young shoots are, neither horse now cow will eat them. But the reason for this is evident when one finds the whole leaf-stalk, the younger parts in particular, densely covered with hairs, which are bitter to the taste. From the view point of the fern this is a splendid arrangement, for the large, succulent young shoots would certainly be much eaten by animals if they were not protected in some way.

It was conceived that these succulent shoots might be valuable as food, so in the spring of 1906 material was gathered for experimental purposes. The upper portion of the shoots was used. It will be observed that the tender part is longest just before the leaf-blade is unrolled. The extreme tips are so rolled up and covered with hairs that it takes too long to clean them, hence they were cut off. The tender part is much longer than that in asparagus, but the bases are woody, as in asparagus, so they were not used. In stalks three feet long as much as one foot is tender. The hairs or scales are loosely attached, and may therefore easily be removed by an ordinary vegetable brush. The stalks were then cooked by various recipes.

To test their palatableness, the dishes were prepared in quantity and offered to classes of fifteen to twenty for judgment. Perhaps three-fourths of these pronounced them good. The taste is not exactly like that of anything else, and like tastes in general, cannot be described except in terms of others. However, to many it suggests the almond. The fern cooks up readily, being softer than asparagus; and it has less woody tissue than asparagus as bought in the market, for the wood is not so near the tip as it is in asparagus. The epidermis is, however, somewhat tougher.

In food values, it compares well with other vegetables of the kind, its nutritive value being near that of cabbage. In comparison with asparagus, which it most resembles, it proves to be superior, containing .87 as

much protein, 1.7 as much fat, and 1.6 as much carbohydrates.

It has been shown that it is a good food, and it has been found palatable by most of those who have tested it. But whether it will become a considerable article of diet or not remains to be seen. The love-apple which was once raised in the flower-garden as a plant of beauty is now highly prized as our vegetable, the tomato. Ignorrance of tastes, habit, and a hesitancy in trying anything new, often prevents one from enjoying some of the best of foods.

The brake was used by the Indians of the Northwest coast before the introduction of wheat flour, but the part used was the subterranean stem. This was dug up, washed, dried, pounded fine, and the coarse shreddy parts removed by sifting. The starchy powder was used as flour. Its use has been discontinued since the introduction of wheat flour. The writer has also been told that the young shoots of the brake are eaten in parts of France.

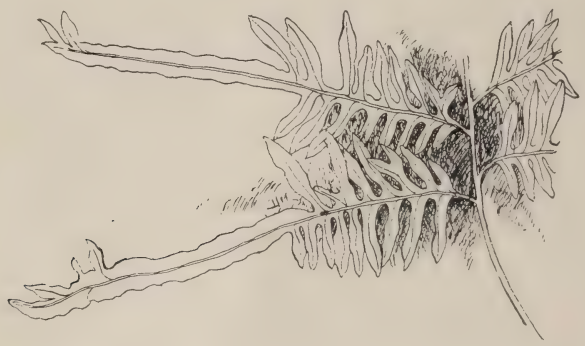
Commercially it is possible that the brake might be canned and sold like asparagus. Should it become a commercial product, the farmer would no longer need to consider it a pest. The season is short, lasting only about three weeks; but the supply is unlimited, and the product may be had for the collecting.—*From an article by Anna C. Dalgity in American Botanist.*

RARE FORMS OF FERNS.—III.

AN ABERRANT PTERIS AQUILINA PSEUDOCAUDATA.

Not many years ago *Pteris caudata*, a West Indian species, was listed as a native of various parts of the United States, but it is not now believed to grow within our limits unless it may occur in the southern part of Florida. The plant that has caused these various reports to be made is a form of our common bracken which I

have named *Pteris aquilina pseudocaudata.* It is simply a form with elongated narrow pinnules, the terminal one being unusually lengthened. It may occur wherever the insolation and small water supply make a reduced leaf surface desirable. For this reason it is most common in



PTERIS AQUILINA PSEUDOCAUDATA

the southern states, where it is often the dominant fern, though it may occur northward in the sandy wastes near the coast as far as Massachusetts. The specimen illustrated was sent me by W. C. Dukes of Mobile, Ala., and represents a not unusual form of the frond in which the terminal pinnule may have a few projections or lobes upon it. The illustration is of two pinnæ from the base of the frond.—*Willard N. Clute.*

The Water Clover.—There never can be rules for the making of common names. The common people will call the plants what they please. In the *Garden Magazine* we find *Marsilia quadrifolia* called water clover, a name that is quite descriptive, although *Marsilia* does not belong to the same grand division of the plant world that clovers do.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(Continued.)

NEPHROLEPIS Schott.

127. **Nephrolepis biserrata** (Sw.). SWORD FERN. Common; in swampy grounds. Southern Florida; also in the West Indies and throughout the tropics.—*N. acuta* (Sw.).

128. **Nephrolepis exaltata** (L.). SWORD FERN. Not uncommon; on palmettoes or sometimes on the ground. Southern Florida; also around the world in the tropics.

NOTHOLAENA R. Br.

129. **Notholaena Aschenborniana** Klotz. Rare; on dry rocks. Texas and Arizona; also in Mexico.

130. **Notholaena candida** (M. & G.). Rare; on dryish ledges. Southern Texas and New Mexico; also in Mexico.

131. **Notholaena cretacea** Liebm. Rare and local; in dry places at the base of rocks. Southern California and Arizona; also in Mexico.

132. **Notholaena dealbata** (Pursh). Not uncommon; on dryish calcareous rocks in light shade. Nebraska and Missouri to Texas and Arizona. —*Pellæa dealbata* (Pursh).

133. **Notholaena Fendleri** Kze. Not uncommon; at the base of rocky ledges. Wyoming to New Mexico and Arizona.—*Pellæa Fendleri* (Kze).

134. **Notholaena ferruginea** (Willd.). Somewhat rare; at the base of rocks. Texas and Arizona.

135. **Notholaena Grayi** Dav. Not rare; on grassy knolls in sun. Texas and Arizona.

136. **Notholaena Hookeri** D. C. Eaton. Rare; in talus at the base of cliffs. Texas to Arizona.

137. **Notholaena Lemmoni** D. C. Eaton. Rare; in dry places. Arizona.

138. **Notholaena Newberryi** D. C. Eaton. Cotton Fern. Abundant in crevices of dry rocks. Southern California; also in Mexico.

139. **Notholaena nivea** Desv. Rare; on dryish rocks. Arizona and New Mexico.—*Pellæa nivea* (Poir).

140. **Notholaena Parryi** D. C. Eaton. Rare; in dry, rocky soil. Utah to Arizona and California.

141. **Notholaena Shaffneri** (Fourn.). Rare; at the base of rocks. Western Texas.

142. **Notholaena sinuata** (Sw.). Not uncommon; on dry rocks often in sun. Texas to Arizona; also in the West Indies and southward to Chili. The form **crenata** Lemmon is reported from Arizona.

143. **Notholaena tenera** Gillies. Very rare and local; in dry soil. Southern Utah, Arizona and California; also in Chili. By many regarded as a form of *N. nivea*.—*Pellæa tenera* (Gillies).

Onoclea L.

144. **Onoclea sensibilis** L. Sensitive Fern. Abundant; in swamps and wet woodlands. Newfoundland and Saskatchewan to Nebraska, Texas and Florida. The form **obtusilobata** Torrey occurs with the type, and is probably caused by an injury to the sterile fronds.

Pellæa L.

145. **Pellaea andromedaefolia** (Kaulf.). Coffee Fern. Common; in stony soil. California and Arizona. The form **rubens** D. C. Eaton is a bronzed variety occurring with the type.

146. **Pellaea aspera** (Hook.). Not uncommon; on

rocks in sun or shade. Western Texas and New Mexico. The form **compacta** Clute is a form with close-set pinnules found with the type.

147. **Pellaea atropurpurea** (L.). PURPLE-STEMMED CLIFF-BRAKE. Common or abundant; on calcareous rocks. Vermont, Ontario and British Columbia to Georgia, Arizona and California; also in Mexico. The form **cristata** Trelease is a crested form from Nevada.

148. **Pellaea brachyptera** (Moore). Not uncommon; on rocks. California and Oregon.

149. **Pellaea Breweri** D. C. Eaton. Rare; on exposed rocks. Montana to Arizona, California and Oregon.

150. **Pellaea Bridgesii** (Hook.). Very rare; on exposed rocks at high altitudes. California.

151. **Pellaea densa** (Brack.). Common; in the crevices of rocks. British Columbia to Montana, Wyoming, Utah and California, and on Mt. Albert, Quebec, and in Grey county, Ontario; also southward to Costa Rica.

152. **Pellaea flexuosa** (Kaulf.). Not uncommon on shaded rocks or in thickets. Western Texas and New Mexico; also from Mexico to Peru and in Santo Domingo.

153. **Pellaea intermedia** Mett. Tolerably common; at the base of dryish rocks. Texas and Arizona.

154. **Pellaea marginata** (H. B. K.). Rare; in crevices of rocks. Huachuca Mountains, Arizona; also southward to Chili. — *Cheilanthes marginata* H. B. K.

155. **Pellaea occidentalis** (E. Nelson). Not uncommon; in crevices of rocks. South Dakota to Wyoming and Washington.

156. **Pellaea ornithopus** Hook. Bird-foot Fern. Common; in sterile half-shaded soil. California.

157. **Pellaea pulchella** (M. & G.). Not common; at the base of dryish rocks. Western Texas and New Mexico; also southward to Peru.

158. **Pellaea ternifolia** (Cav.). Not common; in crevices of rocks. Western Texas; also southward to Chili, in Santo Domingo and the Hawaiian Islands.

159. **Pellaea Wrightiana** Hook. Common; in dry, sterile soil. Kansas to Texas and California. The form **compacta** is found with the type, which is quite variable.—*P. mucronata* D. C. Eaton.

Phegopteris Fee.

160. **Phegopteris alpestris** (Hoppe). Alpine Polypody. Not common; on elevated rocky slopes. Montana and British Columbia to California; also in Europe.—*Athyrium alpestre* (Hoppe).

161. **Phegopteris dryopteris** (L.). Oak Fern. Tolerably common; in moist woodlands. Alaska to Newfoundland, Virginia, Kansas, Colorado and Oregon; also in Greenland, Europe, Northern Asia, Japan and China.—*Dryopteris Linnæana* C. Chr.

162. **Phegopteris hexagonoptera** (Michx.). Broad Beech Fern. Common; in shades, moist or dry. New England to Quebec, Minnesota, Kansas, Louisiana and Florida; also in India.

163. **Phegopteris polypodioides** Fee. Long Beech Fern. Common; on wet rocks in sun or shade. Alaska to Newfoundland, Virginia and Iowa; also in Greenland, Europe, Northern Asia, Japan and the Himalayas.—*Dryopteris phegopteris* (L).

164. **Phegopteris Robertiana** (Hoffm.). Limestone Polypody. Rare; in rich woods. Labrador to Quebec, Minnesota, Iowa and Manitoba; also in Europe and Afghanistan.—*P. calcarea* Fee.; *P. Dryopteris Robertiana* Dav.

165. **Phegopteris reptans** (Sw.). Somewhat rare; on moist calcareous rocks. Southern Florida; also in the West Indies and southward to Brazil. This is as well entitled to be placed in the genus *Nephrodium* as here.—*Dryopteris reptans* (Sw.).

166. **Phegopteris tetragona** (Sw.). Not uncommon; in moist shades. Southern Florida; also in the West Indies and southward to Brazil and Peru.—*Dryopteris tetragona* (Sw.).

PTERIDOGRAPHIA

Additional Dorset Ferns.—I have two additions to make to my list of Dorset (Vt.) ferns: *Botrychium simplex,* and *Pellaea atropurpurea,* both of which I had the pleasure of finding last summer. It is a curious fact that one may go to the same spot, year after year, in search of the same fern and yet fail, year after year, to find it. But my persistence has been rewarded in this instance. My list now numbers fifty-five species and varieties from this locality.—*Mrs. Emily Hitchcock Terry, Northampton, Mass.*

Three Fertile Panicles.—Mr. H. E. Ransier, Manlius, N. Y., sends us an excellent photograph of a plant of the dissected form of the grape fern (*Botrychium ternatum*) possessing three fertile panicles. Such specimens are usually the result of unusual vigor in the plant, and this one is of especial interest from the fact that it is the dissected form which we are often assured, incorrectly, does not grow far from the sea-coast.

Onoclea Sensibilis in the South.—It is well known that the sensitive fern (*Onoclea sensibilis*), so common in northern swamps, does not extend far toward the tropics. Its nearest relative, the ostrich fern, is of the same disposition, and but rarely extends to Virginia. The sensitive fern is found in most of the southern States, but it is rare long before the Gulf is reached. It has been reported from Florida, but evidently through an error. Harper reports it as confined to the upper third of the State of Georgia, Professor Cocks found it near New Orleans, and Reverchon notes it from eastern Texas. In Alabama Dr. Mohr's southernmost station was at Stockton, in Baldwin County. Mr. W. C. Dukes writes that this station is no longer the fern's southern limit, since three colonies of about a dozen plants each were located at Spring Hill, near Mobile, in 1906, by L. H. McNeill. This practically extends the range of the plant to the Gulf. As to the range of the plant in Mississippi not much seems to be known. We hope the publication of the fern flora of that State will throw more light on the subject.

Edible Ferns.—The bracken is doubtless the species of fern most often used as food. Not only is it occasionally thus used in America, but in Japan it is a regular article of commerce and may be found in the markets tied up in small bundles like asparagus. The royal fern (*Osmunda regalis*) is used like the bracken and is often dried for winter use. In the green state many other ferns are used as pot-herbs, being collected just as the young fronds are unrolling. Only the thick and succulent species are selected, such as the cinnamon fern (*Osmunda cinnamomea*), the interrupted fern (*O. claytoniana*), and the ostrich fern (*Struthiopteris Germanica*). The use of the undeveloped fronds in the center of the crown of all ferns of the genus *Osmunda* is well known to children, who in other days at least, ate it under the name of "the heart of Osmund." It is white and tender with a starchy flavor not unlike raw chestnuts.

It is obtained by grasping all the green fronds of a plant and giving them a steady pull. When they break loose, the heart comes with them, but this of course destroys the plant. All these uses, however, are insignificant in comparison with the uses of some of the tropical tree ferns, such as *Cyathea dealbata, C. medullaris, Alsophila excelsa* and *A. australis.* The interior of the trunk or caudex of these ferns consists of a white farinaceous matter that is highly esteemed by the natives and formerly formed no inconsiderable part of their diet.

The Fern Garden.—The best time of the year for transplanting ferns is without doubt the spring of the year, just as the fronds are unrolling, but this has the disadvantage of being done when the ferns are identified with the greatest difficulty. It would be a hard matter for any but a fern student to get a complete collection of the ferns in the nearest woodland by this means. Fortunately for us, the ferns may be safely moved in full leaf if a few simple conditions are observed. The most important of these conditions is that the roots be kept moist. They should not be allowed to become dry at any time and this may be prevented by wrapping each plant in a damp cloth as soon as dug. The fronds of many species may well be cut off and used as packing material, but some discretion must be used in this for much depends upon the species. The ferns may be divided into two groups as regards the way in which the fronds are produced. In one, the fronds for the year all come up in the spring and unless the plant is injured no more are produced. A good example of this group is the cinnamon fern, or the marginal shield fern (*Nephrodium marginale*). The other group, represented by such ferns as the bracken, the sensitive fern and the marsh fern have slender creeping root-stocks that put up fronds all summer. In this second group the removal of the fronds works no injury to the plant since they readily produce new ones, but in the first group the fronds are much more sparingly produced and if the plants are wanted to make

a show as soon as possible an effort to retain the old fronds should be made. In digging the ferns, as many of the roots as possible should be taken as any shortage in the root-system will prevent the fronds from getting sufficient moisture. If any fronds are injured in digging they may be removed as this will also lessen the demands upon the roots for moisture, and when for any reason but few roots can be obtained, all the fronds should be removed. By such treatment the most unpromising specimens may be induced to survive. By proper care in digging and packing, ferns may be kept out of the earth for weeks and transported thousands of miles without harm There are no ferns that cannot be grown in our gardens if proper attention to their wants is given. To have them thrive best, give them situations as nearly like the originals as possible or improve upon them if you can. Some ferns are more easily grown than others and it may be said in a general way that the common ferns are least fastidious as to requirements and that the care necessary to make a rare fern live is in direct proportion to its rarity. The beginner by taking up the common ferns first will soon learn how to care for the rarities.

Packing Fresh Fronds.—The following methods of sending fresh specimens of fern fronds, for long distances, have proved to be excellent. Professor House, while in Washington, sent to me for quite a quantity of *Scolopendriums*, upon which he had run short after offering it. I could not take the time to press them for him and so concluded to ship green by express. I took large heavy sheets of paper, thoroughly paraffined them, cut so that one sheet went down one side of a wooden box, across the bottom, up the opposite side, the ends long enough to cover the top when folded over. Another piece was laid in the box the opposite way, then the ferns were closely packed in, the paraffined papers folded over them and the wood cover nailed on. Mr. House reported their arrival by express in perfect condition. Again last

August I wished to send Dr. Lee, of Bridgeport, Alabama, some *Scolopendriums* to compare with those he was investigating at the nearby Tennessee station. I had a tinker at Jamesville make a tin box 1 x 2 x 20 inches, cover as deep as the box and corners not soldered. Cost me 10c! I packed it full of *Scolopendriums,* moonworts, *Ophioglossum* and walking ferns. Put in some moist moss also. Dr. Lee wrote: "I did not think it possible to deliver specimens in such perfect condition." I planned to start the above box out of Jamesville, N. Y., Saturday evening. After having mailed it I learned that the last mail had gone for the day and that it would not start out till Monday morning. I left it and yet in spite of a day and a half there, besides its long journey, the ferns were delivered in "perfect condition."—*H. E. Ransier, Manlius, N. Y.*

Nephrodium Boottii a Hybrid.—Much has been said and written on both sides of the question as to the hybrid origin of *Nephrodium Boottii.* It is interesting to note that Christiansen's "Index Filicum," recently issued, lists the plant as a hybrid between *N. cristatum* and *N. spinulosum.*

Lygodium as a Decoration.—The Japanese climbing fern (*Lygodium Japonicum*) unlike many other ferns grows with unusual luxuriance in cultivation and some florists are beginning to use its fronds in place of smilax in decorations. It has been found that the fruited pinnæ remain fresh as long or longer than the sprigs of smilax and are no more difficult to grow.

Habitats of Cystopteris Fragilis.—There are few ferns in the world more widely distributed than the common bladder fern (*Cystopteris fragilis*). It has been reported from Alaska, the West Indies, Cape of Good Hope, New Zealand, China, and Europe. Its predilection for moist rocks is well-known and in regions where such habitats are to be found, the fern is rarely found else-

where, but in the woodlands that border the streams through the prairie regions of our Middle West, where no rocks are to be found, the fern grows in the soil like the lady fern usually does. In such woods this fern is usually the most abundant species, and frequently is the only fern to be found.

Fossil Ferns are Rare.—At the autumn meeting of biology teachers at the University of Chicago, Dr. J. M. Coulter discussed the discoveries that have recently been made among the so-called fossil ferns. Botanists generally have long believed that the flowering plants originated from the ferns through some such forms as the fern-like cycads, but there has always been more or less of a break between the two groups. The assumption has usually been made that the connecting links have died out, and if they are ever found at all they will be found among the fossil ferns. The great difficulty in testing this theory heretofore has been that most of our fossil fern remains are not the ferns themselves, but are, instead, the impressions, or casts, which they left in the soft mud that later became the rocks of the coal measures. Recently, however, many silicified fern remains have been found in which the substance of the ferns has been replaced by mineral matter. Such remains show the structure clearly, and may be sectioned and studied like fresh material. One of the first surprises in this study has been the discovery that the great majority of what we have been calling fossil-ferns are in reality seed-plants and not ferns. The ovules have been found to arise directly from the sori and the stamens have been discovered in other sori. The fruits are usually borne in a husk that appears to be derived from the indusium. Possibly this husk is the prototype of the bract that so often encloses the flowers in the lower seed-plants. In any event, these discoveries make clearer the origin of flowers. After all, a stamen is not so far removed from a sporangium. Pollen grains, as is well known, are but spores that grow when brought

in contact with the stigmatic surface of the pistil. The new light that these recent investigations have thrown on the fossil fern-like plants, shows that only about twenty per cent. of the plants known as fossil ferns really are such. The rest are seed-bearing plants, related to the cycads, and forming a group intermediate between them and the ferns, to which the name of Pteridosperms has been given.—*Willard N. Clute.*

Ferns and Lime.—It is often assumed that all ferns love limestone and that certain species will not thrive unless in a soil of this nature. This was once said of the walking fern and it is still the custom to mix limestone, old plaster, etc., with the soil in that part of the fern garden where these ferns are to be placed. But since this idea became current the walking fern has been found on a large number of rocks that contain no trace of lime, and at present not a few believe that the reason for the occurrence of some ferns on limestone is the same as the reason for certain plants growing in alkaline soils or in deserts, namely, that they cannot hold their own against the tenants of other soils. Not only is it true that many ferns are not lovers of lime, but there are some species that cannot endure it. *Lomaria Spicant* and *Cryptogramma crispa* are reported as unable to survive if watered with water containing much lime.

Ferns and Drouth.—It is well known to botanists that drouth is very effectual in causing plants to flower and fruit, and the same thing seems applicable to the fern-worts. The behavior of the various species of *Marsilia* are quite in accordance with the rule. When growing in plenty of water they rarely fruit at all. Fruiting specimens must be looked for among the dilapidated specimens in drier ground. The same is true of *Pilularia* and the species of *Isoetes*. Some of the so-called "terrestrial" species of the latter fruit at the beginning of the dry season, and then drop their leaves, but if supplied with water throughout the year do not drop their leaves and

rarely produce spores. Other species fruit late in summer when most likely to be exposed to drouth. The fact thus illustrated is of wide application among the ferns, and may have an influence upon the production of such forms as *Onocea sensibilis obtusilobata* and *Osmunda cinnamomea frondosa*. Many have conjectured that the last mentioned form is due to a fire sweeping through the locality, while others claim to have found specimens where there were no signs of a forest fire. Drouth at the proper season, however, might account for both occurrences.

Prof Atkinson has held that the *obtusilobata* forms of *Onoclea* and *Struthiopteris* can be produced at will by removing the early sterile fronds, but some of those who have tried to duplicate his results have been unable to do so. It may turn out, after all, that dry weather must be taken into account in producing such forms. Many other habits of ferns point to this theory. Practically all tropical ferns fruit at the beginning of the dry season, and our own ferns, with few exceptions, fruit when their habitat is the driest. Everybody is familiar with the fact that specimens growing in dry ground or in sunlight will be more fruitful than specimens of the same species in shade and moisture. The whole subject is worth a careful investigation.

Fern Genera and Species.—The completion of Christiansen's "Index Filicum" gives us new data upon which to base our calculations of the number of fern species. According to this there are 149 good genera and 5940 species. Of course the majority of these are in the Polypodiaceæ which is regarded as containing 114 of the genera and 4527 of the species. The next two largest genera are Hymenophyllaceæ and Cyatheaceæ, containing 459 and 456 species, respectively. That the industrious name-tinkerer has been ever with us is shown by no less than 670 generic names that are synonyms, and 15,787 specific names that are no longer in use. It is

almost certain that a large number of these synonyms were made prior to the movement for a "stable" nomenclature in America. The number of valid species as given in Christiansen's work will in all probability have to be reduced somewhat, as owing to the circumstances many of the "new species" recently published have been taken upon the authority of their authors.

Absurdity in Nomenclature.—In 1850 a botanist named Unger described a species of *Isoetes* as *I. Braunii*. Fourteen years later this name did not seem to have gained acceptance and Durieu then gave the same name to our well-known quillwort. Somewhat later Engelmann considering this plant but a variety of *I. echinospora* made it *Isoetes echinospora Braunii* and under this name it has been going up to the present. Prof. T. D. A. Cockerell, however, is one of those individuals who cannot let well enough alone and on the strength of that earlier *I. Braunii* of Unger has proposed the name of *I. echinospora Brittoni* for our plant. The absurdity of naming this plant for a botanist who was not born when the plant was first discovered seems not to have occurred to the maker of the new name. We are the last persons to object to honoring a man by naming a plant for him, when the man has been associated with the plant in any way, but this deliberate taking away from one to enrich another, as in this case and others than we can mention (such as *Porteranthus*), is a little too strong for us. There is no likelihood that the two *I. Braunii* will ever be confused. As between Braun and Britton we choose the first.

The Boulder Fern and Water.—Most ferns are so adjusted to moisture and shade that they soon wither when gathered for decorations, but the boulder fern (*Dicksonia pilosiuscula*) which delights in sunny hillside pastures is not one of the number. Although at first glance its finely dissected and delicate fronds would seem

but poorly adapted to withstand drying, it will be found upon experiment that no ferns in our flora are better able to do so. The thick-skinned polypody and the Christmas fern are no match for it. At present florists make great use of the spinulose wood fern (*Nephrodium spinulosum*) for bouquets, but this fern wilts very rapidly. They could apparently gain much by changing to the boulder fern, which has beauty, fragrance, abundance and lasting qualities to recommend it.

Botrychium Lunaria Onondagense.—Mr. H. E. Ransier, Manlius, N. Y., writes: "I have a quantity of moonwort ferns, gathered this fall after the spores were shed. The ferns at this time are usually flat upon the ground and losing their color. I found that the frond could be pulled up without disturbing the bud in the base, the tissue just above the bud being shriveled and weak. Specimens which approach the *B. Lunaria* in size or appearance are rare and this partly leads me to believe that *B. Lunaria Onondagense* is a deserving designation. Ordinarily, I should hesitate to offer such specimens, but knowing their scarcity I offer specimens to members of the American Fern Society for the cost of postage, which is three cents."

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omission from the list.

Campbell, D. H. *Studies on the Ophioglossaceæ.* American Naturalist, March, 1907.—Discusses the morphology of the fruiting part.

Clute, W. N. *Asplenium pinnatifidum in Connecticut.* Fern Bulletin, January, 1907.

Clute, W. N. *Check-list of North American Fernworts.* Fern Bulletin, January, 1907.—A continuation.

Clute, W. N. *Rare forms of Ferns.* II. *A cut-leaved cinnamon Fern.* illust. Fern Bulletin, January, 1907.

Clute, W. N. *Reproduction in the Resurrection Fern.* Fern Bulletin, January, 1907.—Reproduction from parts of the fronds noted.

Clute, W. N. *The Round-leaved Filmy Fern.* Illust. Fern Bulletin, January, 1907.

Dalgity, A. C. *The Common Bracken as Food.* Illust. American Botanist, March, 1907.—Describes methods of cooking, etc.

Ferriss, J. H. *Hardiness of Florida Crest Fern.* Fern Bulletin, January, 1907.—Reported hardy in Illinois.

Harrison, A. K. and others. *Flora of the Boston District*—1. Rhodora, May, 1907.—List of the Ferns.

Hawkins, L. A. *The Development of the Sporangia of Equisetum hyemale.* Illust. Ohio Naturalist, April, 1907.

Hopkins, L. S. *The Fern-flora of Ohio.* Fern Bulletin, January, 1907.

Nehrling, H. *Ferns in Florida.* Florida Agriculturist, May 15, May 22, 1907.

Palmer, T. C. *Rare Local Ferns.* Proceedings of Delaware County Institute of Science. October, 1906.

Pease, A. S. and Moore, A. H. *Botrychium lanceolatum in America.* Rhodora, December, 1906.—*B. lanceolatum angustisegmentum* described as new.

Poyser, W. A. *Isoetes saccharata in the Delaware River.* Fern Bulletin, January, 1907.

Robertson, R. R. *Southern Station for Botrychium simplex.* Fern Bulletin, January, 1907.—Reported from San Bernardino Mts., California.

Strong, M. A. *Regarding Dryopteris filix-mas in Vermont.* Rhodora, February, 1907.

Underwood, L. M. *Concerning Wordwardia paradoxa, a supposedly new fern from British Columbia.* Torrey, April, 1907.—Asserts that *W. paradoxa* is a synonym for *W. radicans* (*W. spinulosa*) of the West Coast.

EDITORIAL.

Readers of this magazine have not yet heard all the reasons for the delay of the January number. When the magazine came from the printer we found it had been printed by mistake on a cheap bluish-white paper, not at all like the paper we use. The issue was then nearly three months late and we were greatly tempted to send it out and trust to luck that our subscribers would not discover the difference. The magazine is still printed at Binghamton, N. Y., and sent to us for mailing and the time consumed in transportation meant more delay, but the editor, who gets more pay from the appearance of the magazine than he does from its income, decided that it must be reprinted, and reprinted it was. The most singular part of the matter was the fact that not more than a dozen subscribers complained of the delay, and these were mostly big public libraries. We wish to say, however, that we thoroughly appreciate the patience of our readers and hope we shall not be called upon to try them in this way again. If anyone would like a copy of that spoiled edition we will be glad to send it, with our compliments. It will serve to show what vigilance is necessary to keep the magazine up to the high standard we have set for it.

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To our way of thinking, the article on nomenclature by Mr. Parish in this issue does not clear the Vienna Congress from making a very foolish rule regarding varietal names. When a plant is named it is *named*, and no amount of juggling will change the facts. It makes no difference what the namer thought of the plant's rank

with regard to other species. He gave it a name. Now comes the Congress and rules that if the one who named the specimen did not guess correctly the position the next generation of name-tinkers would give it, his name is to be turned down and anybody else may guess at it. This is nonsense and not worthy of those gentlemen who laud "priority." In this connection, referring to the remark that an independent code in each country is provincialism, we take pleasure in pointing out that the so-called "American code" is just this very thing, and yet a lot of our prominent botanists appear to be following it. If they can repudiate other wiser rules, why not also include in the repudiation this absurd one that a plant is not named unless the namer is fortunate enough to guess the specific value that others will put upon it.

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For nearly fifteen years this magazine has steadily objected to tinkering with the names of ferns. Our persistence has behind it no desire to belittle the energy of the gentlemen engaged in mixing up plant names, but to insist that this energy would be of greater usefulness if directed into other channels. What we need is more information about ferns and less information about what some dead-and-gone author called them. It has become all too common for individuals with a meagre knowledge of ferns in the field to locate in a library and imagine they are contributing to the sum of our knowledge by rearranging plants and plant-names in systems that will give their own names much prominence.

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Just as this issue is being made up word comes of the death of Mr. B. D. Gilbert, which occurred at his home in Clayville, N. Y., on June 3rd. Mr. Gilbert was for many years a prominent business man in the city of Utica, N. Y., was an authority on dairying and wrote

extensively for the press. He took up fern-study as a recreation, and carrying into it the same thoroughness that characterized his other work, soon became an authority in the subject. He made many expeditions in search of ferns and described numerous species and varieties. It is to his painstaking work that we owe the excellent monographs on the varieties of *Asplenium filix-foemina* and *Polypodium vulgare* in America. Mr. Gilbert was a pleasant and agreeable companion and made friends wherever he was known. He will be greatly missed by the readers of this magazine, but by no one more than the editor. Mr. Gilbert was for a time president of the American Fern Society and a more extended notice will appear in the Annual Report.

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Some years ago the little gray polypody (*P. incanum*) was threatened with a change of name, and in fact a few fern students did adopt the specific name of *polypodioides*. Now the same species is threatened from another quarter. Ivar Tidestrom suggests that the generic name of *Marginaria* be taken up, and *Marginaria polypodioides* it is likely to become in future. Not so many years ago the genus *Polypodium* had quite a respectable showing in the United States, but its ranks have been sadly depleted by the defection of *Phlebodium, Campyloneuron, Phymatodes* and *Marginaria*. It would not be surprising if somebody figured out a way of getting *Eupolypodium* out of the genus.

BOOK NEWS.

We have to thank Dr. E. Rosenstock of Gotha, Germany, for a reprint from *Hedwigia* of his paper on the ferns of Southern Brazil. The paper covers upward of 100 pages and includes descriptions of a large number of new species as well as notes on the other ferns and fern allies of the region. The nomenclature is that of

Christiansen's "Index," and therefore a bit more radical than we are accustomed to in the greater part of America. It is interesting to note that many of the Brazilian species are also represented in the West Indies and some extend as far north as our own regions. We note *Botrychium Virginianum*, *Osmunda regalis*, *O. cinnamomea*, *frondosa*, and several common *Lycopodiums*.

The *Philippine Journal of Science* continues to reflect the activity that characterizes the study of the ferns of the Philippines. In the January number for this year, E. B. Copeland gives an account of the "Comparative Ecology of San Ramon Polypodiaceæ" that is an excellent example of a real contribution to our knowledge of ferns. We shall later make extracts of some of the more interesting portions for this magazine. In the April number an extended account of the Pteridophytes (206 in number) of Mt. Halcon, the third highest of Philippine mountains, is given.

OWNERS OF COMPLETE FILES OF THE FERN BULLETIN.

As a matter of history it is desirable that the location of the twenty-six complete files of THE FERN BULLETIN be put on record, and we print the list below. If our readers know of any other complete sets we shall consider it a favor if they will send us this information. The fortunate owners of the twenty-six known sets are as follows:

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Willard N. Clute & Co., Joliet, Ill.

Vol. XV No. 3

The Fern Bulletin

A Quarterly Devoted to Ferns

Joliet, Ill.
Willard N. Clute & Company
1907

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, EDITOR

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LUCIEN MARCUS UNDERWOOD

THE FERN BULLETIN

VOL. XV JULY, 1907. No. 3

IN MEMORIUM

In the death of three of its most eminent men within a year, American fern study has sustained a loss that will cause the year 1907 to be long remembered. In their demise we lose not only three leaders and authorities but the last of a group of men in which were included D. C. Eaton, John Williamson, Thomas Meehan, and others famous for their researches among the fern worts. The men now most active in fern study were all born since this group began their labors, or at least they began their study of ferns long after these had achieved distinction in the science. To these pioneers, therefore, fell the task of laying the foundations for our present knowledge of ferns and welding the scattered facts and descriptions into one complete whole. They found the study devoid of literature; they left it with many books for its work. They began their work alone and widely removed from one another; they ended with fern students in every town of any size.

First of the recent deaths was that of Benjamin Davis Gilbert, which occurred at his home in Clayville, N. Y., on June 3rd, 1907, after a protracted illness. Following this came that of Lucien Marcus Underwood, who died by his own hand in a fit of temporary insanity Nov. 16, 1907. Last to leave us was George Edward Davenport, who expired suddenly Nov. 29, 1907, while walking with his grandchildren in the Middlesex Fells reservation. A short account of the life and work of each may be a fitting memorial with which this page in fern study closes.

Benjamin Davis Gilbert was born at Albany, N. Y., Nov. 21, 1835, and graduated from Hamilton College in the class of 1857. His father died before he was

JUN 15 1908

born and his mother died six months afterward, thus leaving him to make his own way in the world. That he attained eminence in several walks of life may be taken as some indication of the energy he possessed. At the end of his college course Mr. Gilbert became in succession

BENJAMIN DAVIS GILBERT

broker, book-seller and editor. He was connected with the Utica *Morning Herald* for eleven years and continued to write for it for many years afterward. Leaving the paper he became interested in the manufacture of steel goods, which he continued to the time of his death. For nearly 30 years he served as secretary of the New York State Dairyman's Association, and was author of

a book on cheese-making, issued by the National government.

Mr. Gilbert's interest in ferns began shortly after leaving college. His herbarium, begun then, is one of the largest of private fern herbariums, and includes more than a quarter of all the known species. In the interests of this herbarium he twice visited the West Indies, and also collected in Bermuda, Florida, California, and in the Old World. He was a frequent contributor to the scientific press, most of his work on ferns appearing in the *Torrey Bulletin* and *Fern Bulletin*. Among his more important papers are "A Revision of the Bermuda Ferns," "Polypodium Vulgare in America," "Asplenium filix-foemina and its Varieties," and "A Study of the Tribe Aspidie." He also issued "North American Pteridophytes," a list of the fernworts.

Mr. Gilbert was a member of the Torrey Botanical Club and of the American Fern Society, and served one term as president of the latter society.

Lucien Marcus Underwood was born at New Woodstock, N. Y., Oct. 26, 1853. He began life on a farm. Entering Syracuse University, he was graduated in 1877. The next four years were spent in teaching in small colleges in the middle west. In 1883 he returned to Syracuse University, where he taught for nearly ten years. From 1891 to 1895 he taught in De Pauw University, and the next year went to the Alabama Polytechnic Institute, which he left after a stay of a year, to accept the position of professor of botany in Columbia University. This position he held until his death.

Dr. Underwood's fame as a fern student began with the publication in 1881 of "Our Native Ferns." This was the first American attempt at a manual for naming the ferns, and met with such success that a second edition was required within a year. This has since been followed by four other editions and remains to-day our only manual of the North American fernworts. Another book, "Moulds, Mildews and Mushrooms," has been

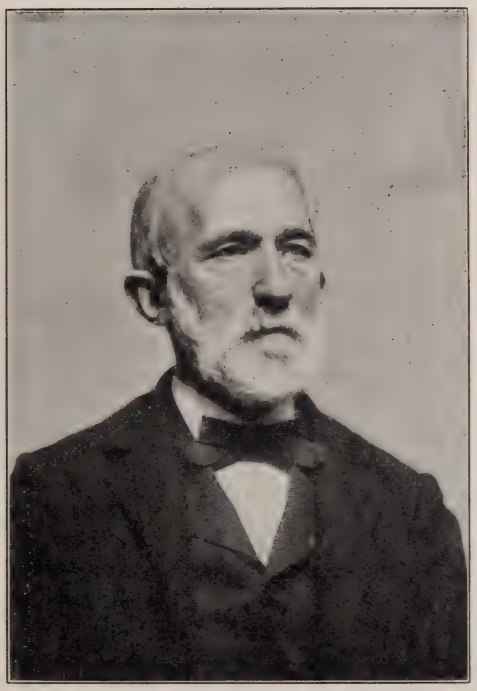
almost as successful. Dr. Underwood was a voluminous writer on his chosen subjects, and his intimate knowledge of critical groups gave his opinion much weight. In his later years he became somewhat radical in his views on nomenclature and species making, but never lost the good opinion of his opponents, however much they differed from him. Among his other published works are "North American Hepaticæ," "Review of the Genera of Ferns," and a multitude of shorter papers, mostly descriptive of new species or revisions of older genera of ferns. Numerous species of fernworts fungi and flowering plants have been named in his honor.

Dr. Underwood was a member of the Torrey Botanical Club and for eight years editor of its *Bulletin* in the pages of which much of his later work appeared. He also published many notes in *The Fern Bulletin.* He was a member of the American Fern Society and chairman of the Board of Scientific Directors of the New York Botanical Garden. Although for more than twenty-five years he has been among the first fern students of the world, he was only in the prime of life, with the prospect of many years of usefulness before him. His untimely end is cause for deep and sincere regret.

George Edward Davenport was born in Boston Aug. 3, 1833, and all his life was spent in or near that city. In his younger days he became acquainted with Wendell Phillips and William Lloyd Garrison and thereafter was counted among their friends. He was always interested in plants and was well known for his contributions to the botany of his State, but it was not until after his marriage that he turned his attention to the ferns.

In 1872 he joined the Massachusetts Horticultural Society and a few years later presented this society with his splendid fern herbarium, to which he continued to add during his life. In acknowledgment of this he was made a life member of the Society and voted the Appleton Gold Medal. He was one of the founders of the Middlesex

Field Club and a leading spirit in the work of preserving the beautiful tract of land and water known as the Middlesex Fells. Many other socities claimed him as a member, among which may be mentioned the New England Botanical Club, Academy of Arts and Sciences, and American Fern Society. He served one term as president of the last named society.



GEORGE EDWARD DAVENPORT

Probably no other American has contributed more to our knowledge of ferns. For more than a quarter of a century his notes and longer papers have been appearing. The earliest papers apeared in *Torrey Bulletin* and *Botanical Gazette*, while most of his recent work has ap-

peared in *Rhodora* and *Fern Bulletin*. Among his more important publications may be mentioned "Monograph of Botrychium Simplex," "Vernation in Botrychium," and "Aspidium Spinulosum and its Varieties." During his lifetime much of the development of the West occurred, and in consequence the naming of many of the western and Mexican ferns fell to his lot. For many years his opinion was sought by Harvard University and the National Government in fern matters. He left unfinished a manual of the ferns of the United States, which he regarded as his most important contribution to fern literature. W. N. C.

FAIRY RINGS OF LYCOPODIUM SABINÆFOLIUM IN MAINE

By Alvin H. Trundy.

In the southern section of Maine, *Lycopodium sabinæfolium* is not of common occurrance but its manner of growth is most interesting. When found at all it occurs in open and rocky pasture-land and grows in large circles or belts. These belts of green are beautiful reminding one strongly of an enormous Christmas wreath of evergreen. One which we visited late in August measured one hundred and forty-five feet in circumference and formed a hollow circle, the space within being filled with the grayish crust-like mass of the reindeer "moss." (*Cladonia rangiferina*). The dark green of the *Lycopodium* contrasted beautifully with the gray of the *Cladonia* and could be easily distinguished at a distance of one half mile. In a series of stations, extending along a range of hills from north to south, it assumes this trait of growing in hollow circles. These are re-enforced annually on the outside margin until the ring is sometimes three feet deep. The fruiting plants are found on the inside margin of the ring, they being the older. The younger plants are always found on the outside margin. This formation of circles seems to be due to the creeping

nature of the plant which carries the young tips outward from the centre. The centre is left vacant by the dying of the older plants. The rings enlarge gradually year by year. The habit is not confined to *Lycopodium sabinæfolium* alone, but is also noticeable in *Lycopodium inundatum*.

Farmington, Maine.

RARE FORMS OF FERNS—IV

A Bipinnatifid Christmas Fern.

It is probable that if one searched long enough he could find bipinnate forms of any of our pinnate ferns,

and corresponding forms for those that are naturally more than pinnate. The numerous sports of *Nephrolepis exaltata* now coming on the market well illustrate the

extremes to which the tendency to become finely divided may be pushed by taking advantage of the most aberrant forms produced. In nature these forms are likely to die out in competition with the type, but by selection they may be continued or even improved. In the bipinnatifid form of the Christmas fern, shown herewith, we have a type that has appeared again and again, but apparently has never been named. As it is well to have terms to designate these variations I here suggest that it be called *Polystichum acrostichoides f. multifida.* As early as 1867 it was reported from New Jersey and a pinnule of this find is illustrated in Eaton's "Ferns of North America." I have also seen specimens from Long Island and still more recently from Connecticut. It is likely to occur wherever the type is found, however. Our illustration was made from specimens from Bristol, Conn., discovered by Mr. W. A. Terry, who now has the plant under cultivation and to whose kindness in sending specimens I am greatly indebted.

The plant possessed by Mr. Terry is much more regularly cut than is usual in the finds of this form and no doubt would find a ready sale if carefully propagated since it is as hardy as the ordinary Christmas fern and far handsomer, standing in this respect in much the same relation to the type as the variations of the so-called Boston fern do to that well-known plant. The illustration is from the middle pinnae of a frond in my herbarium.—*Willard N. Clute.*

THE BOSTON FERN AND ITS SPORTS

By Willard N. Clute.

In Southern Florida, the West Indies and almost around the world in the tropics grows a species of sword fern called *Nephrolepis exaltata.* It has handsome, long, slender drooping fronds and was soon regarded as a fine fern for cultivation in the conservatories of cooler lands. Brought to Massachusetts, the fern or a form of it so nearly like it as to be indistinguishable was sent out as the Boston fern. This form is often called *Nephrolepis exaltata Bostoniensis,* and until recently was one of the most abundant of cultivated ferns. In most places, however, it is now being rapidly supplanted by a numerous progeny that is considered far handsomer. These latter forms have arisen as sports from the original plant and have doubtless been called forth in response to the variations in culture to which it has been subjected for these many years. Only the head of a large establishment for the growing of fern specialties could hope to keep track of all the newly named varieties, but it is proposed here to make a start at it and to add to the list as new forms come under notice. Our country is affected at present by several cults devoted to single species as the dahlia, the sweet pea and the peony. In time we may have a sword fern cult that deals only with the forms of this one species and considers all else as dross. A peculiarity of the gardening fraternity is their fondness for specific values and so we have most of these forms named as if they were distinct species. All of them properly belong to the single species *Nephrolepis exaltata* and will be so listed in this note. Most, if not all of the forms are due to variations in the cutting of the pinnae, such as may be found in the incised forms of the nearly related *Polystichum acrostichoides,* only in these forms the cutting has been carried much

further. One of the first of these forms to make its appearance was Pierson's fern, *Nephrolepis exaltata Piersoni* (*N. Piersoni*). It has finely pinnatifid pinnae and is connected with the type by *N. e. cristata* or perhaps more properly the latter points the way in which the former was produced. The Tarrytown fern *N. exaltata elegantissima* (*N. Piersoni elegantissima*) is like Pierson's fern, but more deeply and finely pinnate with broader fronds. The fact that these are mere sports of *N. exaltata* is shown by the occasional reversion to the type. The very latest in this line is the Superb Boston fern, *N. exaltata superbissima* (*N. superbissima*). To give it the place it deserves according to its lineage it should be named *N. exaltata Bostoniensis elegantissima superbissima,* but it is a mere sport no matter how it was derived. It is of compact growth and heavy texture, and is without question the finest of these plants. Scott's Boston fern, *N. exaltata Scottii* (*N. Scottii*), is a short compact form of the type with nothing in common with the preceding. The Philadelphia lace fern *N. exaltata Amerpohlii* (*N. Amerpohlii*) and *N. exaltata Whitmanii* (*N. Whitmanii*) are somewhat on the type of the *elegantissima* forms and belong to a class of named sports which is likely to be greatly augmented by additions from every big grower's place. A few of these have already claimed attention. *N. exaltata Genyi* (*N. Genyi*) appeared in the collection of Geny Brothers of Nashville and was promptly given a specific name and *N. exaltata todeaoides* (*N. todeaoides*) is a British introduction. It is practically certain that the successes attained with the Boston fern can be duplicated with almost any other fern in cultivation. The characteristics of these varieties seem latent in the type and may be called out by the manipulations of the grower.

DECIDUOUS BRITISH FERNS

Ferns which are natives of cold and temperate climates, in which the conditions of the winter are so rigorous that the frondage is practically destroyed, have developed in large measure the same deciduous or leaf-shedding character as is possessed by the majority of trees. Comparatively few, however, have developed the same capacity of throwing off their fronds at a basal joint, and among our native Ferns only one, Polypodium vulgare, or the common Polypody, has this faculty, which, moreover, does not show itself at the usual leaf-shedding season, the autumn, but only in the spring, when the new fronds are rising to replace the old, and consequently monopolize the root action. In the other species, which are deciduous, the fronds in October or November, or even earlier in some cases, commence without any obvious reason to lose their fresh green tints and become first yellow and finally brown, shrivelling eventually to feather-weight *débris,* owing to the retraction of their sap and any contained nourishment into the crown or root-stock. To many people who do not understand this provision of Nature for a thorough rest, the change is imputed to bad health, and the final disappearance or death of the fronds is thought to mean the death of the fern, the result being subsequent neglect, which makes worse the error. It has so frequently happened in our own experience, especially with lady friends to whom we have given some of our seedlings, that their subsequent loss has been owing to a mysterious disease in the autumn, though every care was taken, that we deem a word of warning not to be out of place in this connection at this season. Losses occur, however, even with those who understand this phenomenon, for where ferns are grown in pots in conservatories the absence of any obvious plant for some months is all too apt to lead to those pots being placed out of sight in

favour of more presentable occupants, the result being that they are forgotten, left altogether unwatered, and thus either perish outright or are greatly weakened by the drought to which they have been unnaturally subjected.

In their natural habitats the sleeping ferns are saturated through the winter beneath a thick blanket of fallen leaves, and there is no doubt that, as with bulbs, the roots are at work preparing for the spring growth long before the centres of growth show any signs of activity. Hence one essential to the well-being of ferns is that they be kept moist throughout the winter, and a good plan is either to pack the pots in a frame with cocoanut fibre or to bury them to their edges in the garden, and mulch them well with dead leaves, thus imitating as far as possible the natural conditions of existence in the dormant period. Our native ferns belong really to three categories, due probably to our comparatively mild winter climate. Thus in the lady ferns, bladder ferns, oak and beech ferns, mountain lastrea, marsh fern, and royal fern we have a class which, however we may treat them, die down altogether in the autumn. Then we have an intermediate section, represented by the soft male fern and broad buckler fern, which only drop their fronds to the ground, but under shelter retain their greenness. Finally, in the hard male fern, the spleenworts, the hart's-tongue, the shield ferns, and blechnum we have thorough evergreens, the fronds of which are retained well into the subsequent season. In making and arranging fern collections it is therefore well to bear these peculiarities in mind, especially with planted out ferns, but of course when grown in pots readjustment in the winter is possible, so as to give good effect even in the dead season. The moral of this note is, however, that dying fronds do not necessarily mean dying ferns, at this period of the year, but that due precautions must be taken as regards watering to ensure that sleep does not culminate in death.—Chas. T. Druery, F. L. S., in *The Garden.*

CASH FOR EVERGREENS

By Willard N. Clute.

Some time ago, I noticed in the columns of a paper, obviously designed for circulation among the less enlightened members of society, the advertisement of a man who wanted people to collect ferns. Scenting something new in the wording of the notice, I sent for particulars and drew some information that I am sure is not generally diffused among readers of The Fern Bulletin. The circular slightly abridged, is as follows:

Dear Friend;

In answer to yours of recent date would say I advertised for people to gather evergreens. Read this letter carefully and you will profit thereby. Sixteen years ago I started in fruit farming, but there was some spare time from October until spring, so I cast about for some way to draw an extra dollar. Having some knowledge of botany and love for the woods I began gathering Christmas Greens. After I had looked up the trade, wholesale and retail, visiting many dealers, getting prices and the different ways of manufacturing, I found there was a large and growing demand for the goods that a farmer could gather in the woods in spare time or one could devote his whole time to it, as there is a market the year around for these goods at a larger profit than can be made on most farms.

The first year I only retailed, my wife, little girl and boy helping make them up. We sold $50 worth. Since then I have learned the Christmas Green business from A to Z, but I cannot supply one thousandth part of the demand, so have decided to let others learn of the chance there is in this line and do the same as myself if they wish. For the last two or three years I have had orders that I could not fill, for a number of tons of pine.

Very few people have any idea of the amount of ferns, oak foliage, bronze and green galax, sphagnum moss, holly, etc., used in the large cities. Chicago alone uses 20,000,000 ferns each year for which $1 a thousand is paid.

There are several kinds of ferns that grow in nearly all parts of the U. S., for which there is a market the whole year. I will tell you how to keep them six months, and where to sell them. How to keep all kinds of greens fresh for three months; how to manufacture wreaths, crosses, festooning and cemetery blankets which bring $5 each. I will direct you how to get good prices and orders for other evergreens for cemeteries.

Thousands of ferns are sold each year on the root stock also there is a large demand for 18 in. to 2½ ft. evergreen trees on the root stock. I will tell you how to sell both of these at good prices.

I will send all of this information complete, samples of different kinds of wire, cord and all material used, sample of ferns, princess pine, laurel, oak, etc. In fact everything used and how to use it so that you can do the same as myself."

I doubt whether any of our readers " with some knowledge of botany and love for the woods " can be induced to root out their ferns and ground pines for the small return to be derived from it, and therefore, have no hesitation in saying that all the valuable information hinted at in the foregoing may be had in exchange for a two-dollar bill from F. P. Barton, Durham, Conn. Reluctantly I put away these visions of wealth, only to have them recalled to me later by a second letter in which our friend Barton observed that he believed me to be an honest, intelligent person and would therefore knock off a dollar of his price if I would go into the business and send him the other dollar as soon as I had made $25 for myself. Alas, he probably thinks I haven't a dollar, for I have not yet gone into the business he so attractively sets forth.

Seriously, it is a question whether the collection and

sale of evergreens is a legitimate industry. Several States have so far discountenanced it as to make laws forbidding the collection of ferns and evergreens from the lands of another without permission, but on the other hand, even the legislators themselves are likely to prove good purchasers of evergreens at the holiday season. Personally I would not sell the evergreens on any land of mine for many times the current price, but so long as the owners of our forests are willing to sweep them away at the command of the highest bidder the lesser products of the woods will doubtless vanish with them.

NOTES ON ASPIDIUM CRISTATUM

This is one of the most interesting species, showing as it does the effects of light and surroundings upon its growth. In its natural habitat it is usually surrounded by a dense low growth of other plants that, like itself, luxuriate in rich, damp woods and swamps. The fertile fronds grow almost vertically and are two or three times as long as the sterile ones which are simply ascending. The fertile fronds no doubt grow this way because it is more important for the preservation and increase of the species that the spore-bearing part of the plant should receive every advantage due to better light, more air, etc., than that the sterile parts should avail themselves of such advantages. It must also be noted that the sterile fronds are a shade lighter in color than the sterile ones on the same plant. But most interesting of all, the pinnules on the fertile fronds are turned so as to lie in a horizontal plane. Reading of this in a book gave me a clue to the following observations: I planted some of the ferns in my yard in the city near a board fence so that they had only a northern exposure. This spring the ferns came up luxuriantly and bore many sori. The ferns nearest the fence had the upper surface of the pinnae turned almost directly outward so that the pinnea were nearly in the plane of the stipe. On the fronds farthest from the fence,

yet not over a foot from it, the pinnae were nearly horizontal. One frond was somewhat inclined and the rachis was twisted but all along the frond the pinnae were set at different angles so that the upper side faced the direction of the brightest light. The most interesting of all was a frond so growing that the back of the frond faced outward. Here the pinnae were inclined at an angle of forty-five degrees and facing the back of the stipe or toward the brightest light. So plain is this evidence that it seems certain that the fern makes every effort to obtain the greatest possible amount of light upon the surface of the fertile fronds, these being the most important. The size and position of the fronds, their darker color and, above all, the peculiarities of their pinnae go to prove this.—C. E. Waters. (Reprinted from *Linnaean Fern Bulletin* No. 1, pages 1 and 2).

ASPIDIUM SPINULOSUM AND ITS VARIETIES

Beginners, as well as more experienced fern collectors, often find it difficult to distinguish *Aspidium spinulosum* from its varieties *intermedium* and *dilatatum* and call them all *spinulosums* as the easiest way to dispose of them. *A. Boottii,* which is about two-thirds *spinulosum* and one-third *cristatum,* generally goes into the same batch as a modified *spinulosum.* No genuine fern lover will feel satisfied with this lumping off process. It makes the study of ferns far more interesting and profitable to be able to recognize the fine points that distinguish species and varieties. Ferns are exceedingly variable in their forms, mainly owing to the kinds and conditions of soil in which they are found, but cases in which they seem to run into each other may be the results of hybridization. In selecting specimens for the herbarium, the typical form, as nearly, as possible, should be chosen and when laid side by side the differences can readily be seen and there need be no confusion. I will briefly enumerate a few of the

distinguishing points which will be helpful to some beginner. If your fern is lance-ovate in outline and twice pinnatifid, the pinnae oblique to the rachis frequently nearly forty-five degrees, with two or three of the lower pairs broadly triangular, those above more elongated, the pinnules also set oblique to the midrib and connected with each other by a narrow wing rather coarsely serrate or lobed each ending in a spinulose tooth the margin of the indusium entire and smooth, you may safely call your specimen *A. spinulosum.* It is generally found in moist, shady woods in the Northern States. If your frond has a longer and broader ovate outline and often thrice pinnate, the pinnae rather distant on the rachis, the lower triangular but unequally so, pinnules crowded, more finely toothed and lobed than above, the margin of the indusium jagged and beset with very small stalked glands (to see them plainly required a glass magnifying twenty or thirty diameters; the sori that protrude from the edges of the indusium must not be mistaken for the glands), it is very probable that your fern is the variety *intermedium.* It is very common in damp woods. If your specimen frond is broader at the base than either of the above approaching triangular ovate and nearly always thrice pinnatifid, the pinnules lance-oblong, the indusium entirely smooth and naked, it is pretty certain you have found the variety *dilatatum.* This form is not so frequently met with as the two above and is generally found on mountains and elevated ground. *A. Boottii* has elongated, lanceolate fronds inclining to oblong in outline. It is thrice pinnatifid, the pinnules broad-oblong, rounded on the ends, somewhat pinnatifid below and serrated above. The indusium is covered with minute glands which give it a rough appearance under the microscope. It is a northern fern and found about ponds and wet places.—James A. Graves. (Reprinted from *Linnaean Fern Bulletin* No. 4, pages 1, 2 and 3.)

EQUISETUM HYEMALE

Summer does not reach us until June 21, although *Equisetum hyemale* seems to think the solstice is on March 23 if we can judge from its fruit. Or perhaps Gray's Manual and Our Native Ferns do not know how to name the seasons when they say of this species "fruiting in summer." I have always found the fertile knobs all through the winter. In the early spring the spores are discharged quite as early, if not earlier than those of E. arvense which "fruits in spring." The spores were perfect, for I have already some young prothallia from them (April 2) simply by sowing them on moist sand in a covered tumbler. At my favorite colony of *E. hyemale* the plant seems to have a great tendency to develop slender branches usually near the top of the stems. Many of these branches bear fertile spikes which are rarely as large as peas.—C. E. WATERS. (Reprinted from *Linnaean Fern Bulletin,* No. 6, page 1.)

PTERIDOGRAPHIA

BOTRYCHIUMS IN SAND.—It has been held by those who are most strenuous in insisting upon a special creation for American plants, that the fern we have for many years called *Botrychium matricariæfolium* cannot be the same as the European plant of the same name, because the European plant is often found in sand along the seashore. In a recent number of *Torreya,* C. B. Robinson reports finding this species in great abundance on sand dunes on the north coast of the Gulf of St. Lawrence, "only ten yards above the reach of ordinary tides. * * * In other terms, they were among the plants which formed the first fringe of veegtation along the coast." The usual habitat of this species is in moist, rich woods, and this new habitat is but another reminder

that we must not be too quick to conclude we have a new species just because it is not exactly like what we assume the nearest old species to be. We are still with Mr. Davenport in maintaining that *Botrychium matricariæfolium* is common to both Europe and America.

Florida Crest Fern.—There are many ways of recognizing a species that are not set down in the manuals. Often the mere habit or way in which a plant grows, whether upright or trailing, may be sufficient to identify it, even as one passes it swiftly on the railway. Coming down to smaller matters, a difference in veining may serve to distinguish two closely allied species. Mrs. A. P. Taylor notes that while the cinnamon fern has been known from its tufts of wool in the angles of the veins, the Florida crest fern (*Nephrodium Floridanum*) has these tufts much larger and may be distinguished by this feature.

Variable Nephrodium Cristatum.—In recent years much—too much, some are inclined to think—has been made of the variations in the common wood fern (*Nephrodium spinulosum*) to the exclusion of variations quite as striking in allied species. This is brought to notice by the observation of Mr. A. A. Eaton in the recently issued 14th Annual Report of the Fern Society, that different localities are likely to present different forms of the crest fern (*N. Cristatum*) and that these varieties prove constant under cultivation. One difference often remarked in specimens of this fern from eastern localities is that they average broader than western forms. It will be worth while to be on the watch for unusual forms of any kind in this species. While upon this subject it may be well to reiterate the idea slowly gaining acceptance, that from the modern viewpoint the plant called *Nephrodium cristatum clintonianum* is entitled to specific rank and should be known as *Nephrodium Clintonianum* or *Aspidium Clintonianum.*

Polynomial Ferns.—Linnaeus conferred unending benefit upon all students of nature by firmly establishing the momenclature of plants and animals upon a binomial system. He found botanical names a medley of adjectives and nouns; he left them in an orderly arrangement of genus and species. Since his time, however, we have been distinguishing varieties, forms and subforms until the names of some of the latter strongly remind one of pre-Linnaean botany. We are again reminded of this by a notice that at a recent meeting of the Royal Horticultural Society of London a certificate was awarded to *Polystichum aculeatum pulcherrimum Dreuryi*. The note further says that "the fern bears no resemblance to any other British fern." It certainly ought not to, with a name like that. It may be added, however, that the British are not the only sinners in this direction. It seems possible that some way might be devised to avoid more than three words in the scientific name.

The Tubers of Nephrolepis.—Any one who has grown *Nephrolepis cordifolia* for any length of time must have noticed the potato-like objects to be found on the underground parts of the plant. According to Prof. J. W. Harshberger, who spoke of the matter some forms of the crest fern (*N. Cristatum*) and that these outgrowths are borne on underground branches and are properly tubers. Most, if not all, the tubers with which we are familiar are storehouses of food, but the tubers of *Nephrolepis* are composed of thin-walled cells filled with water and are therefore more in the nature of cisterns than storehouses. Water, however, is as much a plant food as is starch, so these tubers, after all, act as food storage organs. The reason they contain water instead of starch is probably due to the fact that *N. Cordifolia* is an epiphyte and therefore more subject to drouth than many other plants. The habit of producing these tubers is common to several species of the genus, notably *N. tuberosa, N. Philippinensis, N. pluma,*

N. undulata and *N. Bausei*. Our common *N. exaltata* does not produce them.

Fragrant Cinnamon Fern.—Mrs. A. P. Taylor of Thomasville, Ga., writes that *Osmunda cinnamonea glandulosa* is decidedly aromatic. If bruised early in the day it is of a spicy fragrance. Mrs. Taylor suggests that this may be the origin of the name cinnamon fern, but the evidence appears to be against this. It is a case where the name might have been derived in two ways, just as in the ebony spleenwort, the name is usually considered as given in reference to the ebony-colored stipes, but eben means a stone in some languages, and as the plant prefers rocky or stony places, the name might easily be derived in another way. As to the glandular members of a species being fragrant, it may be noted that most glands on plants secrete a volatile oil and that nearly all such oils are odoriferous. A large number are pleasing to our sense of smell and these we call fragrant, but many are quite otherwise.

The Forms of Onoclea Sensibilis.—I was greatly interested in your article on the *obtusilobata* forms of *Onoclea*, and I was one who tried to produce them by removing the fronds, but it did not work, with me. Now last year was a rather wet season and I found one or two of them; this year has been very dry with us, and I find dozens of them. I found twenty in about a rod square, and can find them anywhere. I wondered at it and I think you hit it about right. Why is it sometimes in the shade it will fruit, and others near, out in the sun, are all sterile.—*H. C. Bigelow, New Britain, Conn.* [Prof. L. S. Hopkins recently submitted to us a series of these forms from Ohio, collected in a locality where there appeared to be little likelihood that the rootstocks had ever been injured in any way. It is not denied that mutilating or removing the early fronds may produce the *obtusilobata* forms, but it seems quite as likely that drouth often causes these forms.—Ed.]

Mailing Small Ferns.—Mr. H. E. Ransier suggests that a most convenient way to mail small ferns is by the use of the "Photo-mailer" envelopes, which may usually be obtained of the nearest stationer or photographer. They are strong and light and protect ferns as well as they do photographs.

Polypodium Vulgare Auritum.—Dr. Fellows in his list of Maine Ferns (Fern Bulletin, October, 1906) states that *Polypodium vulgare auritum* has been found only in one station in the State. This fall I have found it in quite abundance and from specimens I have from other stations I should judge that my find was a very fine one.—*Henry W. Merill, Hiram, Maine.* [We are indebted to Mr. Merrill for some excellent specimens of this but most of the fronds more properly belong to *P. Vulgare hastatum,* which has ears on both sides of the pinnae. Some, however, are eared only on the upper side. As there seems to be no name for this particular form Mr. Merrill's name may well stand for it. The form has been illustrated in *The American Botanist* for September, 1903.—Ed.]

The Eared Walking Fern.—It is not every day that one finds the walking fern (*Camptosorus rhizophyllus*) with the base of the frond prolonged into sharp-pointed "ears." It seems to occur only in the thriftiest plants, and is undoubtedly due to unusual vigor. It will be found upon examination of any leaf that veins and lobes bear a close relationship to each other. When the walking fern puts out these ears they will be found to be coincident with the formation of larger basal veins. The ears behave quite like the tip of the frond and may occasionally root and produce new plants, just as the tip of the frond does. Mr. H. C. Bigelow writes that he found an eared frond recently near New Britain, Conn., that was eighteen inches long. He has found several, always where the soil is moist and the colony shaded. The

lack of a name for the eared form is a most striking instance of how familiar things are overlooked. Had this form not been found until this year, it would immediately have been dubbed *forma hastata* or *auriculata.* It certainly differs as much from the type as many of the forms of *Nephrodium spinulosum* and more than many of the forms of *Botrychium,* whose chief points of specific value are that they grow in different states of our union.

Range of Pteris Serrulata.—The original habitat and range of *Pteris serrulata* is unknown and doubtless always will be. It is supposed on pretty good evidence to have originally come from China or Japan, but it has been cultivated for so long and reproduces so readily by spores that it is now to be found apparently wild at many widely separated points, including our own Southern States, and the West Indies. In regard to its occurrence in Florida, Mrs. A. P. Taylor writes: "On reliable authority I learn that as far back as 1890 it was to be seen in profusion in numerous lime sinks near Ocala, Fla. Many of these sinks were ten and fifteen miles from town or other habitation and at the time I doubt if anyone in the town cultivated a decorative plant. Wherever *Adiantum capillus-veneris* was found—which was in every lime sink— the *Pteris* was seen in much greater profusion. How could this fern have gotten there from China? Fern spores are so light, however, that it seems quite possible for a new colony to appear in any suitable part of the world without the aid of man.

More Complete Sets.—The publication of the list of those who own complete sets of this magazine has brought out information as to the whereabouts of two other sets, both completed since the list was issued. The fortunate owners are Mrs. Annie Morrill Smith, 78

Orange St., Brooklyn, N. Y., and Mr. Chas. W. Jenks, Bedford, Mass. The value of these sets may be estimated from the fact that but seven public libraries have been able to fill their sets, though we have a standing order for the missing numbers. Within the past month single volumes have sold for $3.00, and we know of two or three instances where single copies changed hands at $2.00. Not all the back numbers are worth this much, but these instances go to show the value that may be attached to them. If any of our readers have duplicates of any numbers earlier than volume VI. and will let us know, we will find them purchasers. Meanwhile we would say that if those who have nearly complete sets will send us a list of their lacking numbers on a postal we will do our best to fill their sets. Send on a postal so that your list will be filed with the rest and not overlooked. We have several notices of those whose sets are complete from Vol. V., No. 1. If you are among these let us know.

Hart's-tongue Rooting at the Tip.—Mr. H. E. Ransier, Manlius, N. Y., writes: "*Scolopendrium vulgare* is credited with rooting at the tip of its fronds, occasionally, but who has ever seen it so doing in America? Maxon and House reported *almost* having done so, but as I recall their account of it, it was not a well marked example. My personal observation of the fern has not disclosed a single instance of its occurrence among many thousands of specimens seen the past five years." In reply to this it may be said that any fern, or any other plant for that matter, that produces new plants on any part of itself, does so through the formation of adventitious buds. In flowering plants these adventitious buds are most frequent upon the roots and stems, but they also occur on leaves as in certain begonias. In some plants the adventitious buds are more easily produced than in others and so it happens that only a certain few of our ferns have this habit. The tip of the frond bend-

ing over to the earth is the most natural place for the buds to form, but they do not always form there. While we seem to have no record of the hart's-tongue forming new plants at the tip of the frond in America, Miss Mirick writes that a plant from Chittenango Falls after being grown in a flower-pot for several years finally produced two new plants from the crown.

Reported Find of Cyrtomium.—Mr. W. C. Dukes, Mobile, Ala., writes that he has recently seen fronds of *Cyrtomium falcatum* that are said to have been collected five or six years ago from plants growing wild in Alabama. The exact locality given was a shady ravine near "Montgomery Mill," in Autauga county, Ala., between Montgomery and Prattville, where he was told there is a thriving colony. The identification of the fronds is without doubt, but whether the colony really exists is still problematical. Mr. Dukes is making an investigation at long range and in time will doubtless settle the matter. There seems to be no reason why this fern should not thrive and increase in Alabama, should it once escape to the wild.

Nephrodium Patens.—In nearly all books California is included in the range of *Nephrodium patens,* but this is a rare fern on the Pacific Coast, though common enough in the same latitudes elsewhere. Until recently the only known California locality was at Santa Barbara. Now it is reported from Eaton canyon, near Los Angeles, having been collected there recently by Ernest Braunton, according to *Muhlenbergia.*

Equisetum for Decorations.—Some time ago I saw in a florist's shop, *Equisetum hiemale* used as a covering for flower boxes. The stems were laid on vertically and held in place by cross strips. The effect was decidedly novel and harmonious. It was the first time I have ever seen an Equisetum used for any purpose.—*W. A. Poyser, Philadelphia.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to errors in, or omissions from, this list.

BENEDICT, R, C *Notes on Some Ferns Collected Near Orange, N. J.* Torreya, July, 1907.

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YAMANOUCHI, S. *Apogamy in Nephrodium.* Botanical Gazette, April, 1907.

OWNERS OF COMPLETE FILES. Fern Bulletin, April, 1907.

EDITORIAL.

In the fifteen years of its existence this magazine has made more records and in greater variety than any other in existence. At present we feel confident that we can claim the record for the longest interval between issues. There are two chief reasons for this. First, the editor is trying to handle more work than any two men ought to, and second, the magazine is still published at Binghamton and the distance is responsible for many delays. To remedy this the editor has already planned a great reduction in his work for 1908, and beginning with the new year the magazine will be moved to Joliet, thus saving much time. Meanwhile the dates of the various numbers will indicate not the time they were issued, but the time they ought to have been. A cheap way of catching up, when a magazine gets behind, is to issue two or three issues in one, but that is not our style. Every issue of this magazine contains 32 pages and a frontispiece and our subscribers will get all that is due them. We shall not ask for new subscriptions till the old ones are filled and hope our subscribers will continue to be indulgent to our shortcomings.

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The next number of this magazine will complete fifteen years of continuous publication and our readers may expect something out of the ordinary in consequence. Some of the features that will appear in this issue have never appeared in any other botanical magazine. It is also our wish to have as many of our old contributors represented in this issue as possible and we hereby invite all to send us at least a short note for the issue. Fifteen years in the study of ferns is a long time, measured by what has occurred since the first FERN BULLETIN appeared. We hope those who have all these years helped it on to success

will join with us in an anniversary number that will be second to none.

* *
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If any of the readers of this magazine are interested in wild-flowers as well as ferns it will be worth their while to get a copy of the *American Botanist.* For seven years it has been issued and every number is still of value to the botanist, the gardener and the student of nature. More than half of each issue is made up of notes similar to the Pteridographia of this magazine but dealing with every phase of botany. Nearly three thousand of these notes have been issued, giving an immense amount of information *about* plants. None of the articles are of a technical nature and both the common and scientific names of all plants mentioned are given. The editor of THE FERN BULLETIN is also editor of *The American Botanist,* and will be glad to send samples to all who are interested.

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Notwithstanding the Vienna Botanical Congress and the publication of Christiansen's "Index Filicum," or perhaps in consequence of them, the subject of nomenclature continues to be a bone of contention; in fact, the laws of nomenclature like laws in general, are capable of so many different interpretations that anything but stability and uniformity has resulted from their application. Judging from the many attempts to form a perfect set of rules that have ended in failure we doubt whether any body of scientists can make a set of rules that all their associates would subscribe to. The botanists, especially, are a bit too fond of considering their own interests first and the good of the science afterward. Although the Congress made a set of rules that ought to have produced approximate stability, the various "schools" are apparently as far apart as ever and the existence of an "American Code" is proof of the assertion. It may be asked, how-

ever, what is the use of a botanical congress at all if every member who does not like its rulings comes home more firmly resolved than ever to use his own private brand of nomenclature? We suspect that much of the opposition to the Vienna rules comes from those who have all to gain and nothing to lose by further experiments at rule-making. The *Sassafras Sassafras Sassafras* and *Lablab Lablab Lablab* crowd do not look with complacency upon any proposition to trim their absurd nomenclature. In the main, the Vienna rules should prove satisfactory. The greatest foolishness was the adoption of the rule that a varietal name does not hold when the plant to which it is applied is raised to specific rank. This means, simply, that if you think a named *variety* is more properly a *species* you can give it any new name you choose and have your own name placed after it if you will mention the fact in dog-latin in a botanical publication. This is offering a bonus for name changing and nothing more. Regarding the difference to be paid to forgotten botanizers, the Congress took the right stand in refusing to sacrifice about four hundred well-known genera for " prior " names. It is astonishing to note how botanists who have little respect for other botanists living, to judge from their writings, are ready to accord this respect to dead ones. And the longer they have been dead, the greater the respect. They are so concerned for fear the names of some plant-collector of the olden time will be overlooked that they quite fail to see the trouble their whimsical rules are causing us who are still alive and obliged to use the names daily. We shall ever maintain that if any old name did not get into current use it is not the fault of the present generation,—though paradoxical as it may seem, if it does not now get into common use it will not be the fault of this same generation—and having got used to a later name it does not benefit the science any to make a change. The whole world knows *Cystopteris fragilis* and cannot be fooled into believing that *Filix* is either necessary, advisable or

more ornamental. The same thing applies to *Pteridium, Matteuccia* and all the others. As to the name for the wood ferns, we stand willing to adopt even *Dryopteris* if the leaders will unite on one generic name for them.

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By a recent ruling of the Post Office Department, publishers are now forbidden to send their magazines to subscribers more than four months in arrears, unless they pay a higher rate of postage. This, of course, puts an end to our well-known custom of allowing subscribers to pay each year when they choose. We must, therefore, ask all subscribers now in arrears either to bring their subscriptions up to date or to send us a postal card explicitly ordering the magazine to be continued. One such notice will be sufficient for all time. Simply say please continue sending the magazine until ordered stopped. There are a great many reasons why the subscribers to any magazine should not all pay up to the minute their subscriptions end. Some, undoubtedly, cannot spare the money at the time; others simply neglect the matter because the sum involved is so small, while still others prefer to wait until they owe a considerable sum and make no objection to bills of two or three dollars. We have always been willing to await the pleasure of our subscribers, but now that the paternal government refuses to permit this any longer, we shall have to close up these accounts. With this issue, we include bills for all subscriptions in arrears and ask a prompt reply. Unless all these accounts are heard from within a reasonable time we must send them to a collecting agency. With the explanation we have made, we trust our subscribers will understand that such a course is no reflection upon their honesty or good intentions, in fact, so confident are we that the majority expect to continue to be subscribers that we have billed all of them for a year in advance also. This number, together with the January, 1908, number recently issued, will be construed as completing the sub-

scriptions of those who cease their subscriptions with 1907. The October issue for 1907 will be sent to all others as soon as out. Part of it is already in type as this is written.

AMERICAN FERN SOCIETY

President Ferriss returned from a trip to Arizona recently, bringing with him one fern new to the United States and some unusual forms of the rare species of the southwest.

Mr. Alvin H. Trundy, Farmington, Maine, offers specimens of *Lycopodium sabinæfolium* to members of the Society for the cost of postage—five cents. This club-moss is not a common one, and no doubt many will be glad to avail themselves of Mr. Trundy's offer. Our more fortunate members should not forget those less advantageously situated when collecting rare plants. Those who for various reasons cannot go far from home to collect plants will be very glad to pay the postage on the specimens collected by others.

The annual election of the Society was held in November and resulted in the following officers for 1908: President, James H. Ferriss, Joliet, Ill.; Vice-President, Dr. D. W. Fellows, Portland, Maine; Secretary, W. A. Poyser, 6028 DeLancey Street, Philadelphia; Treasurer, Miss Nellie Mirick, 28 East Walnut Street, Oneida, N. Y. A prosperous and profitable year is certain to be realized.

The annual dues of the Society should be sent to the Treasurer as soon after the first of the year as convenient. It is not customary to send notices that the dues are payable except to those in arrears and an early response to this notice will be appreciated by the officers who are planning the year's work.

This number was issued June, 1908.

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These works scarcely need description. A folder d scribing them will be sent, however, upon application.

Willard N. Clute & Co., Joliet, Ill.

Vol. XV No. 4

The Fern Bulletin

A Quarterly Devoted to Ferns

October

Joliet, Ill.
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WILLARD N. CLUTE, EDITOR

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The American Fern Society

(Formerly Linnæan Fern Chapter)

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LUCIEN MARCUS UNDERWOOD

THE FERN BULLETIN

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IN MEMORIUM

In the death of three of its most eminent men within a year, American fern study has sustained a loss that will cause the year 1907 to be long remembered. In their demise we lose not only three leaders and authorities but the last of a group of men in which were included D. C. Eaton, John Williamson, Thomas Meehan, and others famous for their researches among the fern worts. The men now most active in fern study were all born since this group began their labors, or at least they began their study of ferns long after these had achieved distinction in the science. To these pioneers, therefore, fell the task of laying the foundations for our present knowledge of ferns and welding the scattered facts and descriptions into one complete whole. They found the study devoid of literature; they left it with many books for its work. They began their work alone and widely removed from one another; they ended with fern students in every town of any size.

First of the recent deaths was that of Benjamin Davis Gilbert, which occurred at his home in Clayville, N. Y., on June 3rd, 1907, after a protracted illness. Following this came that of Lucien Marcus Underwood, who died by his own hand in a fit of temporary insanity Nov. 16, 1907. Last to leave us was George Edward Davenport, who expired suddenly Nov. 29, 1907, while walking with his grandchildren in the Middlesex Fells reservation. A short account of the life and work of each may be a fitting memorial with which this page in fern study closes.

Benjamin Davis Gilbert was born at Albany, N. Y., Nov. 21, 1835, and graduated from Hamilton College in the class of 1857. His father died before he was

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born and his mother died six months afterward, thus leaving him to make his own way in the world. That he attained eminence in several walks of life may be taken as some indication of the energy he possessed. At the end of his college course Mr. Gilbert became in succession

BENJAMIN DAVIS GILBERT

broker, book-seller and editor. He was connected with the Utica *Morning Herald* for eleven years and continued to write for it for many years afterward. Leaving the paper he became interested in the manufacture of steel goods, which he continued to the time of his death. For nearly 30 years he served as secretary of the New York State Dairyman's Association, and was author of

a book on cheese-making, issued by the National government.

Mr. Gilbert's interest in ferns began shortly after leaving college. His herbarium, begun then, is one of the largest of private fern herbariums, and includes more than a quarter of all the known species. In the interests of this herbarium he twice visited the West Indies, and also collected in Bermuda, Florida, California, and in the Old World. He was a frequent contributor to the scientific press, most of his work on ferns appearing in the *Torrey Bulletin* and *Fern Bulletin.* Among his more important papers are "A Revision of the Bermuda Ferns," "Polypodium Vulgare in America," "Asplenium filix-foemina and its Varieties," and "A Study of the Tribe Aspidie." He also issued "North American Pteridophytes," a list of the fernworts.

Mr. Gilbert was a member of the Torrey Botanical Club and of the American Fern Society, and served one term as president of the latter society.

Lucien Marcus Underwood was born at New Woodstock, N. Y., Oct. 26, 1853. He began life on a farm. Entering Syracuse University, he was graduated in 1877. The next four years were spent in teaching in small colleges in the middle west. In 1883 he returned to Syracuse University, where he taught for nearly ten years. From 1891 to 1895 he taught in De Pauw University, and the next year went to the Alabama Polytechnic Institute, which he left after a stay of a year, to accept the position of professor of botany in Columbia University. This position he held until his death.

Dr. Underwood's fame as a fern student began with the publication in 1881 of "Our Native Ferns." This was the first American attempt at a manual for naming the ferns, and met with such success that a second edition was required within a year. This has since been followed by four other editions and remains to-day our only manual of the North American fernworts. Another book, "Moulds, Mildews and Mushrooms," has been

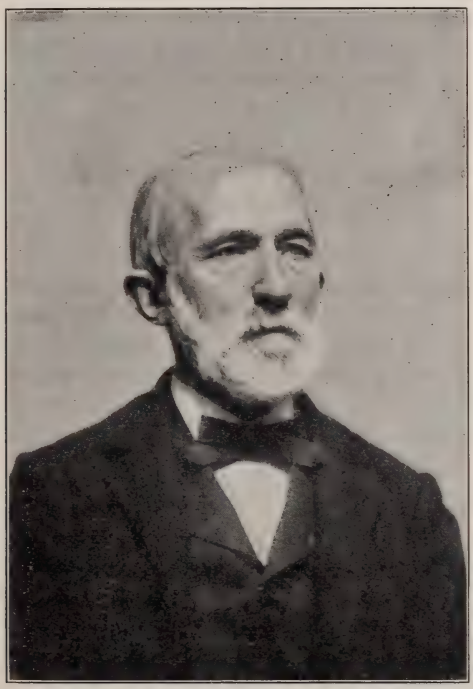
almost as successful. Dr. Underwood was a voluminous writer on his chosen subjects, and his intimate knowledge of critical groups gave his opinion much weight. In his later years he became somewhat radical in his views on nomenclature and species making, but never lost the good opinion of his opponents, however much they differed from him. Among his other published works are "North American Hepaticæ," "Review of the Genera of Ferns," and a multitude of shorter papers, mostly descriptive of new species or revisions of older genera of ferns. Numerous species of fernworts fungi and flowering plants have been named in his honor.

Dr. Underwood was a member of the Torrey Botanical Club and for eight years editor of its *Bulletin* in the pages of which much of his later work appeared. He also published many notes in *The Fern Bulletin.* He was a member of the American Fern Society and chairman of the Board of Scientific Directors of the New York Botanical Garden. Although for more than twenty-five years he has been among the first fern students of the world, he was only in the prime of life, with the prospect of many years of usefulness before him. His untimely end is cause for deep and sincere regret.

George Edward Davenport was born in Boston Aug. 3, 1833, and all his life was spent in or near that city. In his younger days he became acquainted with Wendell Phillips and William Lloyd Garrison and thereafter was counted among their friends. He was always interested in plants and was well known for his contributions to the botany of his State, but it was not until after his marriage that he turned his attention to the ferns.

In 1872 he joined the Massachusetts Horticultural Society and a few years later presented this society with his splendid fern herbarium, to which he continued to add during his life. In acknowledgment of this he was made a life member of the Society and voted the Appleton Gold Medal. He was one of the founders of the Middlesex

Field Club and a leading spirit in the work of preserving the beautiful tract of land and water known as the Middlesex Fells. Many other socities claimed him as a member, among which may be mentioned the New England Botanical Club, Academy of Arts and Sciences, and American Fern Society. He served one term as president of the last named society.



GEORGE EDWARD DAVENPORT

Probably no other American has contributed more to our knowledge of ferns. For more than a quarter of a century his notes and longer papers have been appearing. The earliest papers apeared in *Torrey Bulletin* and *Botanical Gazette*, while most of his recent work has ap-

peared in *Rhodora* and *Fern Bulletin.* Among his more important publications may be mentioned "Monograph of Botrychium Simplex," "Vernation in Botrychium," and "Aspidium Spinulosum and its Varieties." During his lifetime much of the development of the West occurred, and in consequence the naming of many of the western and Mexican ferns fell to his lot. For many years his opinion was sought by Harvard University and the National Government in fern matters. He left unfinished a manual of the ferns of the United States, which he regarded as his most important contribution to fern literature. W. N. C.

FAIRY RINGS OF LYCOPODIUM SABINÆFOLIUM IN MAINE

By Alvin H. Trundy.

In the southern section of Maine, *Lycopodium sabinæfolium* is not of common occurrance but its manner of growth is most interesting. When found at all it occurs in open and rocky pasture-land and grows in large circles or belts. These belts of green are beautiful reminding one strongly of an enormous Christmas wreath of evergreen. One which we visited late in August measured one hundred and forty-five feet in circumference and formed a hollow circle, the space within being filled with the grayish crust-like mass of the reindeer "moss." (*Cladonia rangiferina*). The dark green of the *Lycopodium* contrasted beautifully with the gray of the *Cladonia* and could be easily distinguished at a distance of one half mile. In a series of stations, extending along a range of hills from north to south, it assumes this trait of growing in hollow circles. These are re-enforced annually on the outside margin until the ring is sometimes three feet deep. The fruiting plants are found on the inside margin of the ring, they being the older. The younger plants are always found on the outside margin. This formation of circles seems to be due to the creeping

nature of the plant which carries the young tips outward from the centre. The centre is left vacant by the dying of the older plants. The rings enlarge gradually year by year. The habit is not confined to *Lycopodium sabinæfolium* alone, but is also noticeable in *Lycopodium inundatum.*

Farmington, Maine.

RARE FORMS OF FERNS—IV

A Bipinnatifid Christmas Fern.

It is probable that if one searched long enough he could find bipinnate forms of any of our pinnate ferns,

and corresponding forms for those that are naturally more than pinnate. The numerous sports of *Nephrolepis exaltata* now coming on the market well illustrate the

extremes to which the tendency to become finely divided may be pushed by taking advantage of the most aberrant forms produced. In nature these forms are likely to die out in competition with the type, but by selection they may be continued or even improved. In the bipinnatifid form of the Christmas fern, shown herewith, we have a type that has appeared again and again, but apparently has never been named. As it is well to have terms to designate these variations I here suggest that it be called *Polystichum acrostichoides f. multifida.* As early as 1867 it was reported from New Jersey and a pinnule of this find is illustrated in Eaton's "Ferns of North America." I have also seen specimens from Long Island and still more recently from Connecticut. It is likely to occur wherever the type is found, however. Our illustration was made from specimens from Bristol, Conn., discovered by Mr. W. A. Terry, who now has the plant under cultivation and to whose kindness in sending specimens I am greatly indebted.

The plant possessed by Mr. Terry is much more regularly cut than is usual in the finds of this form and no doubt would find a ready sale if carefully propagated since it is as hardy as the ordinary Christmas fern and far handsomer, standing in this respect in much the same relation to the type as the variations of the so-called Boston fern do to that well-known plant. The illustration is from the middle pinnae of a frond in my herbarium.—*Willard N. Clute.*

THE BOSTON FERN AND ITS SPORTS

By Willard N. Clute.

In Southern Florida, the West Indies and almost around the world in the tropics grows a species of sword fern called *Nephrolepis exaltata.* It has handsome, long, slender drooping fronds and was soon regarded as a fine fern for cultivation in the conservatories of cooler lands. Brought to Massachusetts, the fern or a form of it so nearly like it as to be indistinguishable was sent out as the Boston fern. This form is often called *Nephrolepis exaltata Bostoniensis,* and until recently was one of the most abundant of cultivated ferns. In most places, however, it is now being rapidly supplanted by a numerous progeny that is considered far handsomer. These latter forms have arisen as sports from the original plant and have doubtless been called forth in response to the variations in culture to which it has been subjected for these many years. Only the head of a large establishment for the growing of fern specialties could hope to keep track of all the newly named varieties, but it is proposed here to make a start at it and to add to the list as new forms come under notice. Our country is affected at present by several cults devoted to single species as the dahlia, the sweet pea and the peony. In time we may have a sword fern cult that deals only with the forms of this one species and considers all else as dross. A peculiarity of the gardening fraternity is their fondness for specific values and so we have most of these forms named as if they were distinct species. All of them properly belong to the single species *Nephrolepis exaltata* and will be so listed in this note. Most, if not all of the forms are due to variations in the cutting of the pinnae, such as may be found in the incised forms of the nearly related *Polystichum acrostichoides,* only in these forms the cutting has been carried much

further. One of the first of these forms to make its appearance was Pierson's fern, *Nephrolepis exaltata Piersoni* (*N. Piersoni*). It has finely pinnatifid pinnae and is connected with the type by *N. e. cristata* or perhaps more properly the latter points the way in which the former was produced. The Tarrytown fern *N. exaltata elegantissima* (*N. Piersoni elegantissima*) is like Pierson's fern, but more deeply and finely pinnate with broader fronds. The fact that these are mere sports of *N. exaltata* is shown by the occasional reversion to the type. The very latest in this line is the Superb Boston fern, *N. exaltata superbissima* (*N. superbissima*). To give it the place it deserves according to its lineage it should be named *N. exaltata Bostoniensis elegantissima superbissima,* but it is a mere sport no matter how it was derived. It is of compact growth and heavy texture, and is without question the finest of these plants. Scott's Boston fern, *N. exaltata Scottii* (*N. Scottii*), is a short compact form of the type with nothing in common with the preceding. The Philadelphia lace fern *N. exaltata Amerpohlii* (*N. Amerpohlii*) and *N. exaltata Whitmanii* (*N. Whitmanii*) are somewhat on the type of the *elegantissima* forms and belong to a class of named sports which is likely to be greatly augmented by additions from every big grower's place. A few of these have already claimed attention. *N. exaltata Genyi* (*N. Genyi*) appeared in the collection of Geny Brothers of Nashville and was promptly given a specific name and *N. exaltata todeaoides* (*N. todeaoides*) is a British introduction. It is practically certain that the successes attained with the Boston fern can be duplicated with almost any other fern in cultivation. The characteristics of these varieties seem latent in the type and may be called out by the manipulations of the grower.

DECIDUOUS BRITISH FERNS

Ferns which are natives of cold and temperate climates, in which the conditions of the winter are so rigorous that the frondage is practically destroyed, have developed in large measure the same deciduous or leaf-shedding character as is possessed by the majority of trees. Comparatively few, however, have developed the same capacity of throwing off their fronds at a basal joint, and among our native Ferns only one, Polypodium vulgare, or the common Polypody, has this faculty, which, moreover, does not show itself at the usual leaf-shedding season, the autumn, but only in the spring, when the new fronds are rising to replace the old, and consequently monopolize the root action. In the other species, which are deciduous, the fronds in October or November, or even earlier in some cases, commence without any obvious reason to lose their fresh green tints and become first yellow and finally brown, shrivelling eventually to feather-weight *débris,* owing to the retraction of their sap and any contained nourishment into the crown or root-stock. To many people who do not understand this provision of Nature for a thorough rest, the change is imputed to bad health, and the final disappearance or death of the fronds is thought to mean the death of the fern, the result being subsequent neglect, which makes worse the error. It has so frequently happened in our own experience, especially with lady friends to whom we have given some of our seedlings, that their subsequent loss has been owing to a mysterious disease in the autumn, though every care was taken, that we deem a word of warning not to be out of place in this connection at this season. Losses occur, however, even with those who understand this phenomenon, for where ferns are grown in pots in conservatories the absence of any obvious plant for some months is all too apt to lead to those pots being placed out of sight in

favour of more presentable occupants, the result being that they are forgotten, left altogether unwatered, and thus either perish outright or are greatly weakened by the drought to which they have been unnaturally subjected.

In their natural habitats the sleeping ferns are saturated through the winter beneath a thick blanket of fallen leaves, and there is no doubt that, as with bulbs, the roots are at work preparing for the spring growth long before the centres of growth show any signs of activity. Hence one essential to the well-being of ferns is that they be kept moist throughout the winter, and a good plan is either to pack the pots in a frame with cocoanut fibre or to bury them to their edges in the garden, and mulch them well with dead leaves, thus imitating as far as possible the natural conditions of existence in the dormant period. Our native ferns belong really to three categories, due probably to our comparatively mild winter climate. Thus in the lady ferns, bladder ferns, oak and beech ferns, mountain lastrea, marsh fern, and royal fern we have a class which, however we may treat them, die down altogether in the autumn. Then we have an intermediate section, represented by the soft male fern and broad buckler fern, which only drop their fronds to the ground, but under shelter retain their greenness. Finally, in the hard male fern, the spleenworts, the hart's-tongue, the shield ferns, and blechnum we have thorough evergreens, the fronds of which are retained well into the subsequent season. In making and arranging fern collections it is therefore well to bear these peculiarities in mind, especially with planted out ferns, but of course when grown in pots readjustment in the winter is possible, so as to give good effect even in the dead season. The moral of this note is, however, that dying fronds do not necessarily mean dying ferns, at this period of the year, but that due precautions must be taken as regards watering to ensure that sleep does not culminate in death.—Chas. T. Druery, F. L. S., in *The Garden.*

CASH FOR EVERGREENS

By Willard N. Clute.

Some time ago, I noticed in the columns of a paper, obviously designed for circulation among the less enlightened members of society, the advertisement of a man who wanted people to collect ferns. Scenting something new in the wording of the notice, I sent for particulars and drew some information that I am sure is not generally diffused among readers of The Fern Bulletin. The circular slightly abridged, is as follows:

Dear Friend;

In answer to yours of recent date would say I advertised for people to gather evergreens. Read this letter carefully and you will profit thereby. Sixteen years ago I started in fruit farming, but there was some spare time from October until spring, so I cast about for some way to draw an extra dollar. Having some knowledge of botany and love for the woods I began gathering Christmas Greens. After I had looked up the trade, wholesale and retail, visiting many dealers, getting prices and the different ways of manufacturing, I found there was a large and growing demand for the goods that a farmer could gather in the woods in spare time or one could devote his whole time to it, as there is a market the year around for these goods at a larger profit than can be made on most farms.

The first year I only retailed, my wife, little girl and boy helping make them up. We sold $50 worth. Since then I have learned the Christmas Green business from A to Z, but I cannot supply one thousandth part of the demand, so have decided to let others learn of the chance there is in this line and do the same as myself if they wish. For the last two or three years I have had orders that I could not fill, for a number of tons of pine.

Very few people have any idea of the amount of ferns, oak foliage, bronze and green galax, sphagnum moss, holly, etc., used in the large cities. Chicago alone uses 20,000,000 ferns each year for which $1 a thousand is paid.

There are several kinds of ferns that grow in nearly all parts of the U. S., for which there is a market the whole year. I will tell you how to keep them six months, and where to sell them. How to keep all kinds of greens fresh for three months; how to manufacture wreaths, crosses, festooning and cemetery blankets which bring $5 each. I will direct you how to get good prices and orders for other evergreens for cemeteries.

Thousands of ferns are sold each year on the root stock also there is a large demand for 18 in. to 2½ ft. evergreen trees on the root stock. I will tell you how to sell both of these at good prices.

I will send all of this information complete, samples of different kinds of wire, cord and all material used, sample of ferns, princess pine, laurel, oak, etc. In fact everything used and how to use it so that you can do the same as myself."

I doubt whether any of our readers " with some knowledge of botany and love for the woods " can be induced to root out their ferns and ground pines for the small return to be derived from it, and therefore, have no hesitation in saying that all the valuable information hinted at in the foregoing may be had in exchange for a two-dollar bill from F. P. Barton, Durham, Conn. Reluctantly I put away these visions of wealth, only to have them recalled to me later by a second letter in which our friend Barton observed that he believed me to be an honest, intelligent person and would therefore knock off a dollar of his price if I would go into the business and send him the other dollar as soon as I had made $25 for myself. Alas, he probably thinks I haven't a dollar, for I have not yet gone into the business he so attractively sets forth.

Seriously, it is a question whether the collection and

sale of evergreens is a legitimate industry. Several States have so far discountenanced it as to make laws forbidding the collection of ferns and evergreens from the lands of another without permission, but on the other hand, even the legislators themselves are likely to prove good purchasers of evergreens at the holiday season. Personally I would not sell the evergreens on any land of mine for many times the current price, but so long as the owners of our forests are willing to sweep them away at the command of the highest bidder the lesser products of the woods will doubtless vanish with them.

NOTES ON ASPIDIUM CRISTATUM

This is one of the most interesting species, showing as it does the effects of light and surroundings upon its growth. In its natural habitat it is usually surrounded by a dense low growth of other plants that, like itself, luxuriate in rich, damp woods and swamps. The fertile fronds grow almost vertically and are two or three times as long as the sterile ones which are simply ascending. The fertile fronds no doubt grow this way because it is more important for the preservation and increase of the species that the spore-bearing part of the plant should receive every advantage due to better light, more air, etc., than that the sterile parts should avail themselves of such advantages. It must also be noted that the sterile fronds are a shade lighter in color than the sterile ones on the same plant. But most interesting of all, the pinnules on the fertile fronds are turned so as to lie in a horizontal plane. Reading of this in a book gave me a clue to the following observations: I planted some of the ferns in my yard in the city near a board fence so that they had only a northern exposure. This spring the ferns came up luxuriantly and bore many sori. The ferns nearest the fence had the upper surface of the pinnae turned almost directly outward so that the pinnea were nearly in the plane of the stipe. On the fronds farthest from the fence,

yet not over a foot from it, the pinnae were nearly horizontal. One frond was somewhat inclined and the rachis was twisted but all along the frond the pinnae were set at different angles so that the upper side faced the direction of the brightest light. The most interesting of all was a frond so growing that the back of the frond faced outward. Here the pinnae were inclined at an angle of forty-five degrees and facing the back of the stipe or toward the brightest light. So plain is this evidence that it seems certain that the fern makes every effort to obtain the greatest possible amount of light upon the surface of the fertile fronds, these being the most important. The size and position of the fronds, their darker color and, above all, the peculiarities of their pinnae go to prove this.—C. E. Waters. (Reprinted from *Linnaean Fern Bulletin* No. 1, pages 1 and 2).

ASPIDIUM SPINULOSUM AND ITS VARIETIES

Beginners, as well as more experienced fern collectors, often find it difficult to distinguish *Aspidium spinulosum* from its varieties *intermedium* and *dilatatum* and call them all *spinulosums* as the easiest way to dispose of them. *A. Boottii,* which is about two-thirds *spinulosum* and one-third *cristatum,* generally goes into the same batch as a modified *spinulosum.* No genuine fern lover will feel satisfied with this lumping off process. It makes the study of ferns far more interesting and profitable to be able to recognize the fine points that distinguish species and varieties. Ferns are exceedingly variable in their forms, mainly owing to the kinds and conditions of soil in which they are found, but cases in which they seem to run into each other may be the results of hybridization. In selecting specimens for the herbarium, the typical form, as nearly, as possible, should be chosen and when laid side by side the differences can readily be seen and there need be no confusion. I will briefly enumerate a few of the

distinguishing points which will be helpful to some beginner. If your fern is lance-ovate in outline and twice pinnatifid, the pinnae oblique to the rachis frequently nearly forty-five degrees, with two or three of the lower pairs broadly triangular, those above more elongated, the pinnules also set oblique to the midrib and connected with each other by a narrow wing rather coarsely serrate or lobed each ending in a spinulose tooth the margin of the indusium entire and smooth, you may safely call your specimen *A. spinulosum*. It is generally found in moist, shady woods in the Northern States. If your frond has a longer and broader ovate outline and often thrice pinnate, the pinnae rather distant on the rachis, the lower triangular but unequally so, pinnules crowded, more finely toothed and lobed than above, the margin of the indusium jagged and beset with very small stalked glands (to see them plainly required a glass magnifying twenty or thirty diameters; the sori that protrude from the edges of the indusium must not be mistaken for the glands), it is very probable that your fern is the variety *intermedium*. It is very common in damp woods. If your specimen frond is broader at the base than either of the above approaching triangular ovate and nearly always thrice pinnatifid, the pinnules lance-oblong, the indusium entirely smooth and naked, it is pretty certain you have found the variety *dilatatum*. This form is not so frequently met with as the two above and is generally found on mountains and elevated ground. *A. Boottii* has elongated, lanceolate fronds inclining to oblong in outline. It is thrice pinnatifid, the pinnules broad-oblong, rounded on the ends, somewhat pinnatifid below and serrated above. The indusium is covered with minute glands which give it a rough appearance under the microscope. It is a northern fern and found about ponds and wet places.—James A. Graves. (Reprinted from *Linnaean Fern Bulletin* No. 4, pages 1, 2 and 3.)

EQUISETUM HYEMALE

Summer does not reach us until June 21, although *Equisetum hyemale* seems to think the solstice is on March 23 if we can judge from its fruit. Or perhaps Gray's Manual and Our Native Ferns do not know how to name the seasons when they say of this species "fruiting in summer." I have always found the fertile knobs all through the winter. In the early spring the spores are discharged quite as early, if not earlier than those of E. arvense which "fruits in spring." The spores were perfect, for I have already some young prothallia from them (April 2) simply by sowing them on moist sand in a covered tumbler. At my favorite colony of *E. hyemale* the plant seems to have a great tendency to develop slender branches usually near the top of the stems. Many of these branches bear fertile spikes which are rarely as large as peas.—C. E. WATERS. (Reprinted from *Linnaean Fern Bulletin,* No. 6, page 1.)

PTERIDOGRAPHIA

BOTRYCHIUMS IN SAND.—It has been held by those who are most strenuous in insisting upon a special creation for American plants, that the fern we have for many years called *Botrychium matricariæfolium* cannot be the same as the European plant of the same name, because the European plant is often found in sand along the seashore. In a recent number of *Torreya,* C. B. Robinson reports finding this species in great abundance on sand dunes on the north coast of the Gulf of St. Lawrence, "only ten yards above the reach of ordinary tides. * * * In other terms, they were among the plants which formed the first fringe of veegtation along the coast." The usual habitat of this species is in moist, rich woods, and this new habitat is but another reminder

that we must not be too quick to conclude we have a new species just because it is not exactly like what we assume the nearest old species to be. We are still with Mr. Davenport in maintaining that *Botrychium matricariæfolium* is common to both Europe and America.

Florida Crest Fern.—There are many ways of recognizing a species that are not set down in the manuals. Often the mere habit or way in which a plant grows, whether upright or trailing, may be sufficient to identify it, even as one passes it swiftly on the railway. Coming down to smaller matters, a difference in veining may serve to distinguish two closely allied species. Mrs. A. P. Taylor notes that while the cinnamon fern has been known from its tufts of wool in the angles of the veins, the Florida crest fern (*Nephrodium Floridanum*) has these tufts much larger and may be distinguished by this feature.

Variable Nfphrodium Cristatum.—In recent years much—too much, some are inclined to think—has been made of the variations in the common wood fern (*Nephrodium spinulosum*) to the exclusion of variations quite as striking in allied species. This is brought to notice by the observation of Mr. A. A. Eaton in the recently issued 14th Annual Report of the Fern Society, that different localities are likely to present different forms of the crest fern (*N. Cristatum*) and that these varieties prove constant under cultivation. One difference often remarked in specimens of this fern from eastern localities is that they average broader than western forms. It will be worth while to be on the watch for unusual forms of any kind in this species. While upon this subject it may be well to reiterate the idea slowly gaining acceptance, that from the modern viewpoint the plant called *Nephrodium cristatum clintonianum* is entitled to specific rank and should be known as *Nephrodium Clintonianum* or *Aspidium Clintonianum.*

Polynomial Ferns.—Linnaeus conferred unending benefit upon all students of nature by firmly establishing the momenclature of plants and animals upon a binomial system. He found botanical names a medley of adjectives and nouns; he left them in an orderly arrangement of genus and species. Since his time, however, we have been distinguishing varieties, forms and subforms until the names of some of the latter strongly remind one of pre-Linnaean botany. We are again reminded of this by a notice that at a recent meeting of the Royal Horticultural Society of London a certificate was awarded to *Polystichum aculeatum pulcherrimum Dreuryi.* The note further says that " the fern bears no resemblance to any other British fern." It certainly ought not to, with a name like that. It may be added, however, that the British are not the only sinners in this direction. It seems possible that some way might be devised to avoid more than three words in the scientific name.

The Tubers of Nephrolepis.—Any one who has grown *Nephrolepis cordifolia* for any length of time must have noticed the potato-like objects to be found on the underground parts of the plant. According to Prof. J. W. Harshberger, who spoke of the matter some forms of the crest fern (*N. Cristatum*) and that these outgrowths are borne on underground branches and are properly tubers. Most, if not all, the tubers with which we are familiar are storehouses of food, but the tubers of *Nephrolepis* are composed of thin-walled cells filled with water and are therefore more in the nature of cisterns than storehouses. Water, however, is as much a plant food as is starch, so these tubers, after all, act as food storage organs. The reason they contain water instead of starch is probably due to the fact that *N. Cordifolia* is an epiphyte and therefore more subject to drouth than many other plants. The habit of producing these tubers is common to several species of the genus, notably *N. tuberosa, N. Philippinensis, N. pluma,*

N. undulata and *N. Bauseii.* Our common *N. exaltata* does not produce them.

Fragrant Cinnamon Fern.—Mrs. A. P. Taylor of Thomasville, Ga., writes that *Osmunda cinnamonea glandulosa* is decidedly aromatic. If bruised early in the day it is of a spicy fragrance. Mrs. Taylor suggests that this may be the origin of the name cinnamon fern, but the evidence appears to be against this. It is a case where the name might have been derived in two ways, just as in the ebony spleenwort, the name is usually considered as given in reference to the ebony-colored stipes, but eben means a stone in some languages, and as the plant prefers rocky or stony places, the name might easily be derived in another way. As to the glandular members of a species being fragrant, it may be noted that most glands on plants secrete a volatile oil and that nearly all such oils are odoriferous. A large number are pleasing to our sense of smell and these we call fragrant, but many are quite otherwise.

The Forms of Onoclea Sensibilis.—I was greatly interested in your article on the *obtusilobata* forms of *Onoclea,* and I was one who tried to produce them by removing the fronds, but it did not work, with me. Now last year was a rather wet season and I found one or two of them; this year has been very dry with us, and I find dozens of them. I found twenty in about a rod square, and can find them anywhere. I wondered at it and I think you hit it about right. Why is it sometimes in the shade it will fruit, and others near, out in the sun, are all sterile.—*H. C. Bigelow, New Britain, Conn.* [Prof. L. S. Hopkins recently submitted to us a series of these forms from Ohio, collected in a locality where there appeared to be little likelihood that the rootstocks had ever been injured in any way. It is not denied that mutilating or removing the early fronds may produce the *obtusilobata* forms, but it seems quite as likely that drouth often causes these forms.—Ed.]

Mailing Small Ferns.—Mr. H. E. Ransier suggests that a most convenient way to mail small ferns is by the use of the "Photo-mailer" envelopes, which may usually be obtained of the nearest stationer or photographer. They are strong and light and protect ferns as well as they do photographs.

Polypodium Vulgare Auritum.—Dr. Fellows in his list of Maine Ferns (Fern Bulletin, October, 1906) states that *Polypodium vulgare auritum* has been found only in one station in the State. This fall I have found it in quite abundance and from specimens I have from other stations I should judge that my find was a very fine one.—*Henry W. Merill, Hiram, Maine.* [We are indebted to Mr. Merrill for some excellent specimens of this but most of the fronds more properly belong to *P. Vulgare hastatum,* which has ears on both sides of the pinnae. Some, however, are eared only on the upper side. As there seems to be no name for this particular form Mr. Merrill's name may well stand for it. The form has been illustrated in *The American Botanist* for September, 1903.—Ed.]

The Eared Walking Fern.—It is not every day that one finds the walking fern (*Camptosorus rhizophyllus*) with the base of the frond prolonged into sharp-pointed "ears." It seems to occur only in the thriftiest plants, and is undoubtedly due to unusual vigor. It will be found upon examination of any leaf that veins and lobes bear a close relationship to each other. When the walking fern puts out these ears they will be found to be coincident with the formation of larger basal veins. The ears behave quite like the tip of the frond and may occasionally root and produce new plants, just as the tip of the frond does. Mr. H. C. Bigelow writes that he found an eared frond recently near New Britain, Conn., that was eighteen inches long. He has found several, always where the soil is moist and the colony shaded. The

lack of a name for the eared form is a most striking instance of how familiar things are overlooked. Had this form not been found until this year, it would immediately have been dubbed *forma hastata* or *auriculata*. It certainly differs as much from the type as many of the forms of *Nephrodium spinulosum* and more than many of the forms of *Botrychium*, whose chief points of specific value are that they grow in different states of our union.

Range of Pteris Serrulata.—The original habitat and range of *Pteris serrulata* is unknown and doubtless always will be. It is supposed on pretty good evidence to have originally come from China or Japan, but it has been cultivated for so long and reproduces so readily by spores that it is now to be found apparently wild at many widely separated points, including our own Southern States, and the West Indies. In regard to its occurrence in Florida, Mrs. A. P. Taylor writes: "On reliable authority I learn that as far back as 1890 it was to be seen in profusion in numerous lime sinks near Ocala, Fla. Many of these sinks were ten and fifteen miles from town or other habitation and at the time I doubt if anyone in the town cultivated a decorative plant. Wherever *Adiantum capillus-veneris* was found—which was in every lime sink— the *Pteris* was seen in much greater profusion. How could this fern have gotten there from China? Fern spores are so light, however, that it seems quite possible for a new colony to appear in any suitable part of the world without the aid of man.

More Complete Sets.—The publication of the list of those who own complete sets of this magazine has brought out information as to the whereabouts of two other sets, both completed since the list was issued. The fortunate owners are Mrs. Annie Morrill Smith, 78

Orange St., Brooklyn, N. Y., and Mr. Chas. W. Jenks, Bedford, Mass. The value of these sets may be estimated from the fact that but seven public libraries have been able to fill their sets, though we have a standing order for the missing numbers. Within the past month single volumes have sold for $3.00, and we know of two or three instances where single copies changed hands at $2.00. Not all the back numbers are worth this much, but these instances go to show the value that may be attached to them. If any of our readers have duplicates of any numbers earlier than volume VI. and will let us know, we will find them purchasers. Meanwhile we would say that if those who have nearly complete sets will send us a list of their lacking numbers on a postal we will do our best to fill their sets. Send on a postal so that your list will be filed with the rest and not overlooked. We have several notices of those whose sets are complete from Vol. V., No. 1. If you are among these let us know.

Hart's-tongue Rooting at the Tip.—Mr. H. E. Ransier, Manlius, N. Y., writes: "*Scolopendrium vulgare* is credited with rooting at the tip of its fronds, occasionally, but who has ever seen it so doing in America? Maxon and House reported *almost* having done so, but as I recall their account of it, it was not a well marked example. My personal observation of the fern has not disclosed a single instance of its occurrence among many thousands of specimens seen the past five years." In reply to this it may be said that any fern, or any other plant for that matter, that produces new plants on any part of itself, does so through the formation of adventitious buds. In flowering plants these adventitious buds are most frequent upon the roots and stems, but they also occur on leaves as in certain begonias. In some plants the adventitious buds are more easily produced than in others and so it happens that only a certain few of our ferns have this habit. The tip of the frond bend-

ing over to the earth is the most natural place for the buds to form, but they do not always form there. While we seem to have no record of the hart's-tongue forming new plants at the tip of the frond in America, Miss Mirick writes that a plant from Chittenango Falls after being grown in a flower-pot for several years finally produced two new plants from the crown.

Reported Find of Cyrtomium.—Mr. W. C. Dukes, Mobile, Ala., writes that he has recently seen fronds of *Cyrtomium falcatum* that are said to have been collected five or six years ago from plants growing wild in Alabama. The exact locality given was a shady ravine near "Montgomery Mill," in Autauga county, Ala., between Montgomery and Prattville, where he was told there is a thriving colony. The identification of the fronds is without doubt, but whether the colony really exists is still problematical. Mr. Dukes is making an investigation at long range and in time will doubtless settle the matter. There seems to be no reason why this fern should not thrive and increase in Alabama, should it once escape to the wild.

Nephrodium Patens.—In nearly all books California is included in the range of *Nephrodium patens,* but this is a rare fern on the Pacific Coast, though common enough in the same latitudes elsewhere. Until recently the only known California locality was at Santa Barbara. Now it is reported from Eaton canyon, near Los Angeles, having been collected there recently by Ernest Braunton, according to *Muhlenbergia.*

Equisetum for Decorations.—Some time ago I saw in a florist's shop, *Equisetum hiemale* used as a covering for flower boxes. The stems were laid on vertically and held in place by cross strips. The effect was decidedly novel and harmonious. It was the first time I have ever seen an Equisetum used for any purpose.—*W. A. Poyser, Philadelphia.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to errors in, or omissions from, this list.

BENEDICT, R, C *Notes on Some Ferns Collected Near Orange, N. J.* Torreya, July, 1907.

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Ransier, H. E. *Botrychium Lunaria Onondagense.* Fern Bulletin, April, 1907.

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Terry, E. H. *Additional Dorset Ferns.* Fern Bulletin, April, 1907.

Yamanouchi, S. *Apogamy in Nephrodium.* Botanical Gazette, April, 1907.

Owners of Complete Files. Fern Bulletin, April, 1907.

EDITORIAL.

In the fifteen years of its existence this magazine has made more records and in greater variety than any other in existence. At present we feel confident that we can claim the record for the longest interval between issues. There are two chief reasons for this. First, the editor is trying to handle more work than any two men ought to, and second, the magazine is still published at Binghamton and the distance is responsible for many delays. To remedy this the editor has already planned a great reduction in his work for 1908, and beginning with the new year the magazine will be moved to Joliet, thus saving much time. Meanwhile the dates of the various numbers will indicate not the time they were issued, but the time they ought to have been. A cheap way of catching up, when a magazine gets behind, is to issue two or three issues in one, but that is not our style. Every issue of this magazine contains 32 pages and a frontispiece and our subscribers will get all that is due them. We shall not ask for new subscriptions till the old ones are filled and hope our subscribers will continue to be indulgent to our shortcomings.

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The next number of this magazine will complete fifteen years of continuous publication and our readers may expect something out of the ordinary in consequence. Some of the features that will appear in this issue have never appeared in any other botanical magazine. It is also our wish to have as many of our old contributors represented in this issue as possible and we hereby invite all to send us at least a short note for the issue. Fifteen years in the study of ferns is a long time, measured by what has occurred since the first FERN BULLETIN appeared. We hope those who have all these years helped it on to success

will join with us in an anniversary number that will be second to none.

* *
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If any of the readers of this magazine are interested in wild-flowers as well as ferns it will be worth their while to get a copy of the *American Botanist.* For seven years it has been issued and every number is still of value to the botanist, the gardener and the student of nature. More than half of each issue is made up of notes similar to the Pteridographia of this magazine but dealing with every phase of botany. Nearly three thousand of these notes have been issued, giving an immense amount of information *about* plants. None of the articles are of a technical nature and both the common and scientific names of all plants mentioned are given. The editor of THE FERN BULLETIN is also editor of *The American Botanist,* and will be glad to send samples to all who are interested.

* *
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Notwithstanding the Vienna Botanical Congress and the publication of Christiansen's "Index Filicum," or perhaps in consequence of them, the subject of nomenclature continues to be a bone of contention; in fact, the laws of nomenclature like laws in general, are capable of so many different interpretations that anything but stability and uniformity has resulted from their application. Judging from the many attempts to form a perfect set of rules that have ended in failure we doubt whether any body of scientists can make a set of rules that all their associates would subscribe to. The botanists, especially, are a bit too fond of considering their own interests first and the good of the science afterward. Although the Congress made a set of rules that ought to have produced approximate stability, the various "schools" are apparently as far apart as ever and the existence of an "American Code" is proof of the assertion. It may be asked, how-

ever, what is the use of a botanical congress at all if every member who does not like its rulings comes home more firmly resolved than ever to use his own private brand of nomenclature? We suspect that much of the opposition to the Vienna rules comes from those who have all to gain and nothing to lose by further experiments at rule-making. The *Sassafras Sassafras Sassafras* and *Lablab Lablab Lablab* crowd do not look with complacency upon any proposition to trim their absurd nomenclature. In the main, the Vienna rules should prove satisfactory. The greatest foolishness was the adoption of the rule that a varietal name does not hold when the plant to which it is applied is raised to specific rank. This means, simply, that if you think a named *variety* is more properly a *species* you can give it any new name you choose and have your own name placed after it if you will mention the fact in dog-latin in a botanical publication. This is offering a bonus for name changing and nothing more. Regarding the difference to be paid to forgotten botanizers, the Congress took the right stand in refusing to sacrifice about four hundred well-known genera for "prior" names. It is astonishing to note how botanists who have little respect for other botanists living, to judge from their writings, are ready to accord this respect to dead ones. And the longer they have been dead, the greater the respect. They are so concerned for fear the names of some plant-collector of the olden time will be overlooked that they quite fail to see the trouble their whimsical rules are causing us who are still alive and obliged to use the names daily. We shall ever maintain that if any old name did not get into current use it is not the fault of the present generation,—though paradoxical as it may seem, if it does not now get into common use it will not be the fault of this same generation—and having got used to a later name it does not benefit the science any to make a change. The whole world knows *Cystopteris fragilis* and cannot be fooled into believing that *Filix* is either necessary, advisable or

more ornamental. The same thing applies to *Pteridium*, *Matteuccia* and all the others. As to the name for the wood ferns, we stand willing to adopt even *Dryopteris* if the leaders will unite on one generic name for them.

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By a recent ruling of the Post Office Department, publishers are now forbidden to send their magazines to subscribers more than four months in arrears, unless they pay a higher rate of postage. This, of course, puts an end to our well-known custom of allowing subscribers to pay each year when they choose. We must, therefore, ask all subscribers now in arrears either to bring their subscriptions up to date or to send us a postal card explicitly ordering the magazine to be continued. One such notice will be sufficient for all time. Simply say please continue sending the magazine until ordered stopped. There are a great many reasons why the subscribers to any magazine should not all pay up to the minute their subscriptions end. Some, undoubtedly, cannot spare the money at the time; others simply neglect the matter because the sum involved is so small, while still others prefer to wait until they owe a considerable sum and make no objection to bills of two or three dollars. We have always been willing to await the pleasure of our subscribers, but now that the paternal government refuses to permit this any longer, we shall have to close up these accounts. With this issue, we include bills for all subscriptions in arrears and ask a prompt reply. Unless all these accounts are heard from within a reasonable time we must send them to a collecting agency. With the explanation we have made, we trust our subscribers will understand that such a course is no reflection upon their honesty or good intentions, in fact, so confident are we that the majority expect to continue to be subscribers that we have billed all of them for a year in advance also. This number, together with the January, 1908, number recently issued, will be construed as completing the sub-

scriptions of those who cease their subscriptions with 1907. The October issue for 1907 will be sent to all others as soon as out. Part of it is already in type as this is written.

AMERICAN FERN SOCIETY

President Ferriss returned from a trip to Arizona recently, bringing with him one fern new to the United States and some unusual forms of the rare species of the southwest.

Mr. Alvin H. Trundy, Farmington, Maine, offers specimens of *Lycopodium sabinæfolium* to members of the Society for the cost of postage—five cents. This club-moss is not a common one, and no doubt many will be glad to avail themselves of Mr. Trundy's offer. Our more fortunate members should not forget those less advantageously situated when collecting rare plants. Those who for various reasons cannot go far from home to collect plants will be very glad to pay the postage on the specimens collected by others.

The annual election of the Society was held in November and resulted in the following officers for 1908: President, James H. Ferriss, Joliet, Ill.; Vice-President, Dr. D. W. Fellows, Portland, Maine; Secretary, W. A. Poyser, 6028 DeLancey Street, Philadelphia; Treasurer, Miss Nellie Mirick, 28 East Walnut Street, Oneida, N. Y. A prosperous and profitable year is certain to be realized.

The annual dues of the Society should be sent to the Treasurer as soon after the first of the year as convenient. It is not customary to send notices that the dues are payable except to those in arrears and an early response to this notice will be appreciated by the officers who are planning the year's work.

This number was issued June, 1908.

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These works scarcely need description. A folder describing them will be sent, however, upon application.

Willard N. Clute & Co., Joliet, Ill.

Vol. XV No. 4

The Fern Bulletin

A Quarterly Devoted to Ferns

Joliet, Ill.
Willard N. Clute & Company
1907

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, EDITOR

WILLARD N. CLUTE & CO., PUBLISHERS, JOLIET, ILL.

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The American Fern Society

(Formerly Linnæan Fern Chapter)

PRESIDENT, JAMES H. FERRISS, JOLIET, ILL.

SECRETARY, WILLARD N. CLUTE, JOLIET, ILL.

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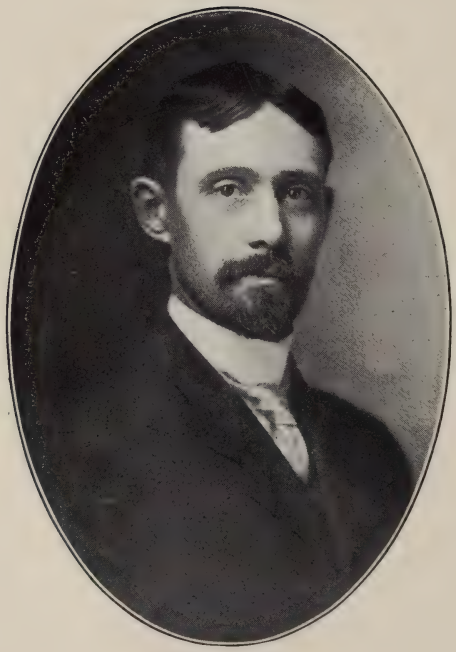

THE EDITOR

THE FERN BULLETIN

VOL. XV OCTOBER, 1907. No. 4

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FIFTEEN YEARS OF FERN STUDY

By WILLARD N. CLUTE.

With the present number, THE FERN BULLETIN completes fifteen years of continuous publication. To the editor it seems but yesterday since the first tiny numbers of the *Linnæan Fern Bulletin*—with pages so much smaller than the current issues that they are often facetiously referred to as the prothallium stage of THE FERN BULLETIN—were issued; and yet, so much has been accomplished in fern study during this time that we begin to realize how inadequate as a standard of measurement any mere term of years is. When we began publication, practically all the authorities on American ferns were living. John Williamson had died less than ten years earlier, but we still had with us John Goldie, Daniel Cady Eaton, Thomas Meehan, John Redfield and Sadie F. Price. One by one these have passed away, to be joined more recently by Benjamin D. Gilbert, George E. Davenport and L. M. Underwood. All that remain to us of those whow ere writing on ferns when this magazine first appeared are S. B. Parish and Marcus E. Jones. Those whom we must now call authorities were then boys and girls at school. We are not, however, entirely without links connecting us with that earlier time, for the sons of John Goldie and R. B. Scott, the latter the discoverer of *Asplenium ebenoides,* are still on our subscription list. These are men in middle life, but we have several subscribers whose memory must outrun theirs, for several have passed the 85th milestone of life's journey and one, having passed ninety, has his eye set on the hundred mark.

JAN 5 - 1909

When the first tiny issue of this magazine appeared we had no idea that it was to herald a great movement in the study of ferns. In those days the identification of ferns was not the simple task it is at present. Williamson's "Ferns of Kentucky" (1878) was rare and hard to get, Jones' "Ferns of the West" (1882) did not apply to the region in which most of the study of ferns was carried on and the cost of D. C. Eaton's "Ferns of North America" (1879) placed it beyond the reach of most students. Robinson's "Ferns in their Homes and Ours" (1879) though a manual for the cultivator did much to increase an interest in our favorites. It is true that the first edition of Underwood's "Our Native Ferns" appeared in 1880, but it was not until some time after THE FERN BULLETIN began to be issued that the popular handbooks, of which we now have so many, began to appear. First of these was the modest little volume of Raynal Dodge entitled "The Ferns and Fern Allies of New England" (1896) then came Sadie F. Price's "Fern Collector's Handbook" (1897) long since out of print. The well-known "How to Know the Ferns" by Mrs. Parsons appeared in 1899, the editor's "Our Ferns in Their Haunts" appeared two years later, and in the following year came his "Guide to the Ferns." Then followed Water's "Ferns" (1903), Eastman's "New England Ferns and Their Common Allies" (1904), Woolson's "Ferns, and How to Grow Them" (1905), Clute's "Fern Allies of North America" (1905), the latter the only popular work on this subject, and Miss Slosson's "How Ferns Grow" (1906). Mention should also be made of the fact that in 1900 appeared the sixth and last edition of Underwood's "Our Native Ferns." The student whose library is graced by a majority of the above-mentioned books may try to imagine what it meant to name the ferns without them. Those were the days when to be an authority on ferns meant more than it does at present, and beginners rejoiced when they

found some older student willing to give names to even the common things they sent him.

It would be unprofitable to repeat here various other facts that have arisen in connection with our magazine. They have for the most part been chronicled in our review of a decade of fern study, published in the tenth volume. Mention may be made, however, of the impetus which has been given to the study of the fern allies. In the early days, fern students seldom paid any attention to them; the early fern lists did not include them, and the first books did not even mention them. Now practically everyone interested in ferns is interested in the allies as well. To this magazine must also go part of the credit for the present activity in the study of mosses, for *The Bryologist,* now a strong independent journal, is a child of The Fern Bulletin, and for two years was published as part of it. That the ferns themselves have also gained by the spread of fern study may be seen from the fact that fifteen years ago the best list of ferns contained less than 250 names, while the latest contains more than double that number.

In the fifteen years of publication, this magazine has made several unique records. Starting with the field full of botanical publications, it has continued on its way unaided, until it is the third oldest of the strictly botanical publications in America. What this means in the way of good hard work only editors of similar publications can appreciate. This magazine is, so far as we are aware, the only one that for its entire existence has been in charge of a single editor and the only one that has not been subsidized in one way or another by club or society. It is also the only one that has never missed a number, nor doubled up two numbers in one. And, last but by no means least, it is the only publication of its kind in the world.

No one realizes better than the editor how much the success of the magazine is due to the steady encourage-

ment of its contributors. To name them all would be to list all the writers on ferns in America. We cannot refrain, however, from a mention of Messrs. Saunders, Maxon, A. A. Eaton, Graves, Bates, Dodge, Flett, Hill, House, Waters, Dukes Ransier, Ferriss, Hans, and Miss Slosson. To these, and to all the others who have helped *our* magazine to success, the sincere thanks of the editor are extended.

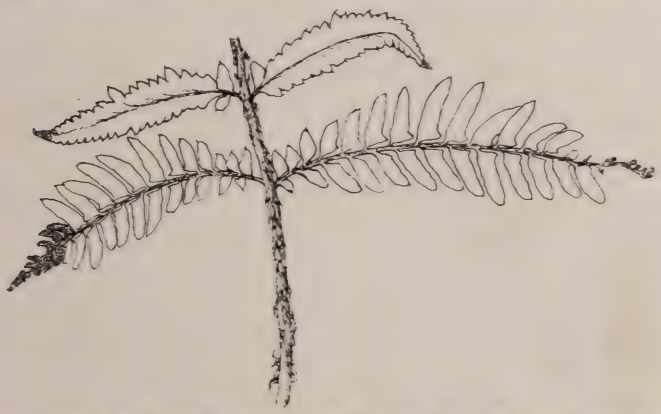
The study of the ferns and fern allies must continue to change with changing conditions. New species are no longer among the probabilities, though forms and varieties may still be found for many years to come. In the recording of these, with such additional facts about old species as may come to light, is work sufficient to keep the magazine busy for many years. That it may continue to engage in this work is the earnest hope of its editor.

Habitat of Polypodium Scouleri.—In the *Fern Bulletin* 9:40-42, 1901, Mr. S. B. Parish has a paper entitled "Southern Extension of the Range of Polypodium Scouleri." I chanced upon it recently, and note that in speaking of this species, he says: "Although this sometimes grows in the soil, its usual situation is the mossy trunks of trees." I have collected it on the San Bruno hills, San Francisco, and near the shore beyond Pacific Grove, Monterey County, and at both places it was growing on large granite boulders in crevices where a foothold could be obtained. Both of the localities cited are exposed to the cool ocean winds as well as to considerable fog, and are outside the line of arborescent growth.—*A. A. Heller in Muhlenbergia.*

RARE FORM OF FERNS—V

POLYSTICHUM ACROSTICHOIDES VAR. INCISUM INTERPRETED.

On October 19, 1907, near the edge of a swamp in the town of Lowman, N. Y., I found a clump of *Polystichum acrostichoides* var. *incisum*. The lower pinnæ were incised to an unusual degree, several fronds being cleft to the midrib, and one frond, which had been broken off one-third the way from the tip, by wind or cattle



perhaps, had its lower pinnæ fully divided into auricled pinnules so as to form miniature fronds with the tips fruited as in the ordinary form. As the second and third pairs of pinnæ were in all respects like the lower pinnæ of typical *incisum*, this was evidently a case of the incisum tendency carried to its logical conclusion.

I have often wondered why incising of the lower pinnæ is accompanied by fruiting at their tips, and had never been able to see any relation between the two modifications until this plant made it clear that they are two manifestations of an attempt of a pinna to grow into a frond. And since the resulting frond, as the illustration shows, is a typical frond, fruited at the tip, and not var. *incisum*, it seems evident that this is not a variety at all, but, as Mr. Hopkins suggests in the BULLETIN for January, 1907, a late growing form of the species, and should be called "forma *incisum*."—E. J. WINSLOW, *Elmira, N. Y.*

ECOLOGY OF SOME TROPICAL FERNS

The following account of the adaptations of ferns to their environment is condensed from an extended article on "The Comparative Ecology of San Ramon Polypodiaceæ," by Edward Bingham Copeland, published in the *Philippine Journal of Science* for January, 1907. The parts reprinted here are those which bear more directly upon the modifications which the ferns have evolved to fit them for their places in the plant world.

It has already been shown that large fronds are characteristic of habitats having a moist air, and that, on the other hand, large fronds, by virtue of their size, are more or less xerophytic in their finer structure. Very large fronds must have stout stipes and rhizomes which are well anchored. The caudex of the huge rain-forest variety of *Aspidium luzeanum* is ten centimeters in diameter. All our *Dennstaedtias* except *D. Erythrorachis* have very stout prostrate rhizomes. The enormous fronds of *Angiopteris* and *Marattia* spring from globose caudexes which are often thirty centimeters in diameter. Epiphytes have comparatively small fronds, the few exceptions being supported in an exceptional manner, namely, *Asplenium musaefolium, Polypodium heracleum* and *Platycerium,* by massive nests which, in large specimens, completely invest the supporting branch or trunk, as is sometimes the case with the stout rhizomes of *Polypodium musaefolium, Drynaria quercifolia* and *Thayeria.*

The margins of large fronds are always reinforced to give a protection against tearing. This protection may be by marginal anastomoses of the veins, as in the case of *Asplenium phyllitidis;* by walls merely thicker near the margin, as in *Cyclopeltis;* or by a more or less broad and rigid cartilaginous border, as in the case of *Hymenolepis* and *Acrostichum.* When the margin is deflexed, a very common occurrence, it is less likely to tear. If the frond is lobed or incised, the sinuses are the places

needing reinforcement. They are reinforced by the venation of *Goniopteris* and by a broader border of cartilage in *Polypodium affine* and other species. The special reinforcement of the sinuses can serve only as a protection against tearing, but the reinforcement of the margin as a whole is equally a protection against gnawing animals. It is probably of use in this way to many smaller ferns. Cartilaginous borders, if sharp or deflexed, also help to keep the nether surface dry.

The ready removal of water from the frond is insured and facilitated in various ways. One of these is by a smooth, even waxy, unwettable surface, as in *Asplenium phyllitidis*. Caudate tips are very familiar structures serving this end, and, of course, acuminate tips in general are more common and less conspicuous structures of the same kind. The removal of water from an erect fern is brought about in the same way, by an attenuate base, like that of *Dipteris* and *Meniscium*. Essentially like these are plants such as *Odontosoria,* with cuneate, erect pinnules. Pinnæ drawn down at the base instead of attached horizontally will drain in the same way. The reduction of the basicopic half of the pinna has the same effect, the part of the lamina which is removed being that portion which could not readily drain down the rachis. This modification is begun in *Asplenium vulcanicum*, carried further in *A. tenerum* and its relatives and in *Polystichum;* farther still in *Asplenium resectum,* and completed in our dimidiate *Lindsayas* and *Adiantum*.

If detracted pinnæ are carried further they become decurrent, forming a wing on the rachis and stipe which serves at once as a drain for water, aside from any value it may have in increasing the leaf area. A broad wing is sometimes convex upward on both sides, effecting a depression along the axis, as in *Polypodium papillosum,* the pinnæ of *Pteris longifolia* and the whole frond of *Polypodium caudiforme*. The fine divisions of *Onychium* are concave above. Many ferns have very

narrow, erect wings, continuous along the rachis or along the rachis and stipe opening laterally at the insertions of the pinnæ. An effect similar to that of the winged stipe is produced by the auricles of the pinnæ of some species standing close to, or against, the rachis and each underlying the base of succeeding pinnæ. *Nephrolepis cordifolia* is an illustration. The convexity of the major areolæ of *Polypodium affine* and *P. heracleum* can conduct water along the main veins and costæ just as a wing, convex as a whole does, and the rows of close-set papillæ on the segments of *P. papillosum* must operate in the same way.

Irrespective of the ease or difficulty of becoming wet (as a matter of fact, for a reason which I shall presently develop, cut, incised and dissected fronds shed water), finely dissected fronds dry readily by evaporation. There are two reasons for this: the limited single surfaces preventing the holding of much water, and the ready agitation brought about by movements of air. Aside from these general adaptations to promote the facile escape of water from a frond, there are various other devices which prevent the passage of water to its nether surface. A very simple structure of this kind is the convexity of the ultimate divisions of the frond, such as that of the segments of *Blechnum egregium* and the ultimate pinnules of *Nephrodium setigerum.* To reach the nether surface of any of these structures, water would have to run up-hill from the margin. This is equally the case when the margin of an otherwise plane frond or division is deflexed, as in *Antrophium plantagineum, Polypodium punctatum* and *Acrostichum.* In the majority of these plants the margin is sharp as well as deflexed. A few species have a sharp margin which is not deflexed. The sharpness alone must prevent a *drop* of water from running to the nether surface. If the entire surface is wet, the water need not perhaps move in drops, but might move in a film around even a sharp edge, but so

long as the nether surface is not wet, or is imperfectly so, the surface tension of a drop would cause it to become spherical on an edge as sharp as the one under discussion, and it would therefore fall off.

Overfullness of the margin causes an effect like that produced by convexity of frond. Such margins are wavy or crisped, alternately raised and depressed. Water will, of course, run to the margin where it is lowest, and only to this point; these are the places where it would have to run upward to wet the nether surface. An example is *Polypodium macrophyllum*. Such fronds can hardly be torn, because the extra length of their margins allows them merely to straighten if the fronds are bent toward the other side. A ciliate margin is, as a rule, an obstacle to the passage of water; for if the hairs are not wet, a drop must pass over their ends, from which it will inevitably fall off, but if they are wet, they usually furnish an opportunity for water to run down far enough to fall, instead of allowing it to pass to the nether surface. As a matter of fact, neither the hairs nor the cuticle of plants in general are very readily wet.

If we suppose a frond to be horizontal, then the possibility of a drop passing from the upper to the nether surface depends upon the area of contact which it can preserve with the frond while rounding the margin. If the frond is in some other position, the area of contact is still a very important factor. Unless this area is sufficient to allow a drop to flatten into a broad enough oval markedly to reduce its relative surface over which it would be were the drop a sphere, and thus to overcome the force with which gravity can act to remove the drop from the leaf, it will inevitably assume the form of a sphere, and fall.

We have just seen that the surface tension of a drop must prevent it passing around a sharp edge; now, if drops run to a toothed margin they must run in part over the sinuses. If the sinus were a curve with a ra-

dius equal to or greater than that of the drop, or if the radius were not much less, the drop would have an area of contact greater than it would have in passing the entire margin, and so it would pass more readily. Such sinuses are found in *Dipteris,* but they are so placed that water to reach them would have to run up-hill. I have found such sinuses in no other fern. If a drop runs to a sharp sinus, or to one much narrower than the diameter of the drop, then the sides of the sinus will hold it up and make it run outward to where the sinus widens or the ends of the teeth are reached. If the sinus widens sufficiently to allow the drop to run through, then even though the frond is quiet enough so as not to cause it to be shaken off when its contact is limited, and although it might return to the body of the frond while still touching both sides of the sinus without its having to run up-hill, nevertheless it is more than likely to leave the frond because of its impetus in falling through the sinus; this condition is easily demonstrated. If a drop runs out *onto* a tooth it loses its opportunity to pass to the nether surface by diminishing its possible contact, just as it does if it runs on to a caudate tip. In general, water must run to the teeth rather than to the sinuses, because its surface tension prevents its starting over an edge if it can run along it. Thus a toothed or cut margin in all parts of its periphery is provided with a water-removing structure such as caudate leaves have at the apex. I have demonstrated the inability of water to pass around a narrowly or sharply cut margin by experiments on various ferns. A very much larger proportion of terrestrial than of epiphytic ferns have such margins; as epiphytes, by virtue of their position, will be injured for a comparatively short time by their wetness of the nether surface.

In a few ferns there are special adaptations to make the sinuses impassable to water. The sinus is elevated in *Nephrodium syrmaticum* and others. It is obstructed by local hairs, the rest of the margin being less ciliate,

or not at all so, in *Nephrodium diversilobum* and *Stenosemia.* In *Polypodium celebicum* and a number of its congeners the frond is cut so closely to a very hairy rachis that the hairs on the latter may obstruct the sinuses.

I am convinced that here we have the correct interpretation of serrate and otherwise inoffensively toothed margins. These structural peculiarities are among those most widespread, but hitherto they have been accepted as facts without an attempt at a general explanation being made. There are doubtless a sufficient number of instances in which this explanation will not apply, and many more in which its application is not evident, but among these must not be included the cause of the existence of those spiny margins, properly regarded as xerophytic characters, which are produced directly by strong insolation, dryness or exposure to wind, for these more often between the sharp teeth have rounded sinuses through which water might run more readily than it would around a straight or slightly convex margin.

Dryness of the nether surface in the ferns is doubly desirable, both for the sake of the fructification and also to avoid plugging the stomata. The protection of the fruit will be discussed later. The stomata are confined to the nether surface of every vegetative frond in the entire fern flora of San Ramon except in the single case of *Monogramma,* which has no differentiated ventral surface. Epiphytes dispense with incised margins more commonly than do terrestrial forms because, if their nether surface should be wet the water will be removed with relative promptness by evaporation; but among both groups, epiphytes and geophytes, it is almost invariably true that fronds which have margins entire in detail have other devices adapted for keeping their nether surfaces dry. Among these are sharp, deflexed or ruffled margins, convex or minute ultimate divisions of other forms adapted to the facile escape of water from the frond.

Besides the excretion of a cuticle sufficiently waxy to be more or less unwettable, many ferns have outer walls the convexity of which is a strong factor in the same direction. These convex walls are sometimes confined to the nether surface, sometimes they are more convex in such situations. Such an adaptation is naturally to be found chiefly in ferns growing in places where they are likely often to be wet; as a matter of fact, it is confined entirely to ferns growing in such places. It has already been remarked that half the depth of the cell in *Adiantum diaphanum* is made of the projections. Between walls which are convex to this extent and trichomes, no line can be drawn. Dry trichomes, unicellular or pluricellular, occur over the mesophyll of various species of *Nephrodium* and others. Very many species have them on the veins, the reason for this restriction being the mechanical one that their bases can be more firmly anchored in the more solid walls to be found there. A better protection against wetting than is produced by dry hairs is furnished by glandular ones such as are to be found in many species of *Nephrodium*. These are of characteristic form, size and color for each species.

Stomata occur on the upper surfaces of the fertile fronds of *Acrostichum* and *Cheiropleura* and on all four faces of those of *Monogramma;* otherwise they are entirely confined to the nether surfaces of all our ferns. Here they may be equally distributed or they may be in streaks or, to a limited measure, in groups. They occur only over the parenchyma. The number varies from 7 to 400 per square millimeter. As a general rule, the number and size vary in opposite directions. In most ferns, the outer walls of the guard cells are in the same plane as the outer walls of the epidermal cells.

The specialization of the epidermal cells of ferns is what the environment demands. In terrestrial species, with very few exceptions, they are not extremely differentiated from the parenchyma, but that this difference be-

tween the majority of the ferns and the majority of spermaphytes is adaptive, not a primitive character on the part of the ferns is amply proved by the exceptions. Some species in every tribe of Polypodiaceæ represented at San Ramon are without chlorophyll in the epidermis. The spicular cells of the Vittarieæ have already been mentioned, and in four tribes, Davallieæ, Asplenieæ, Polypodieæ and Acrosticheæ, are species which have carried protective specialization deeper than the epidermis, having a specialized hypodermis. In the majority of ferns it is more correct to describe the epidermis as specialized in other directions than for protection than to call it undifferentiated. In very numerous ferns it is, indeed, a highly specialized photosynthetic tissue which is not infrequently more specialized than any part of the parenchyma. In *Adiantum diaphanum* an especially large share of the photosynthesis falls to the epidermis, the upper and nether epidermis being in direct contact in a considerable part of the frond. It will be noticed that the ones which have been mentioned in this connection are nearly all terrestrial species, but some very large terrestrial species are like many epiphytes in the more or less complete suppression of chlorophyll in the epidermis, this being the case in *Nephrodium ferox, N. cyatheoides* and the huge variety of *Aspidium luzeanum.*

It is the mesophyll rather than the epidermis which shows less specialization in the ferns than in the seed plants. In the parenchyma the differentiation is especially backward. A complete and typically developed palisade parenchyma does not occur, but layers which are like it in compactness and more or less approaching it in form and arrangement of the cells are found in many species. According to its necessity, a hyaline epidermis has been differentiated in one or more genera of every tribe. This is usually found only beneath the upper epidermis, but underlies the nether as well in *Davallia solida, Asplenium musæfolium, Polypodium incurvum* and

others. This tissue is found only in xerophytes, and the notion has some time had vogue that its function is to act as a water-store. That this is not in general the case I have pointed out elsewhere. Among the ferns, the walls of the hypodermis are almost invariably so thick that any change in size or form, which is necessary if they are to give up any water, is quite impossible.

On the other hand, there are a very few species provided with an evidently available store of water. Thus *Polypodium caudiforme,* with two layers of non-collapsible cells under the upper epidermis, has one layer of collapsible ones next the nether one. The walls of the green parenchyma of *Loxogramma iridifolia, Antrophyum reticulatum* and *Polypodium accedens* are somewhat collapsible with loss of water, but not greatly so. In this direction again, it is *Niphobolus* of all our ferns in which specialization has gone farthest. *Niphobolus* is likewise the only genus having trichome-hydathodes. These hairs are different in form, those of each of our species being characteristic, our most xerophytic species, *N. adnascens,* being glabrescent; but they are all alike in insertion, each hair growing in a pit which is practically filled by the basal cell of the trichome. The basal cell is alive with considerable evident contents. When the leaf is damp, the contents fill the cell; it can then absorb water from the cells borne on it whether they are dead or alive, and give water to the cells within. Judging by the high turgor in *Niphobolus* leaves this movement must be fairly active. When the outside of the leaf becomes dry, the outer cells of these trichomes lose their water and promptly draw on the basal cell. If the connection were maintained, the basal cell would then supply itself from the interior of the leaf. But this does not happen, because its protoplasm instead of keeping in connection with the cells within and without shrink away from its wall and contracts into a lump touching but one end of the cell. A dead air space, or approximate vacuum, in

the basal cell then protects the interior of the leaf from evaporation. The protoplasm of the basal cell collapses instead of maintaining its turgidity, because it loses water outward faster than it can get it from within. This condition must be due both to the very high turgor of the mesophyll and to the unequal permeability of the end-walls of the basal cell, their outer ends being pitted.

Very many ferns have their vein tips hyaline and, as a rule, the clear spots are hydathodes, clear because of the absence of air-containing spaces. Such hydathodes are found among other ferns in *Meniscium, Arthropteris, Nephrolepis,* many *Aspleniums, Hymenolepis,* numerous *Polypodiums* and various others. White incrustations of lime are regularly found on these hydathodes on some species of *Nephrolepis,* and occasionally on various other ferns. There are other hyaline vein-tips, as in *Asplenium subnormale,* which are not active hydathodes, though perhaps potential ones.

Except as it is modified by correlation with other structural peculiarities, such as fineness of dissection of the frond, the venation in general is decidedly closer in species of arid than those of humid habitats. Anastomosis of the veins makes the venation closer in effect, and, as a general proposition, with many exceptions, ferns with anastomosing veins are more xerophytic in habitat than those with free veins. The frequent correlation between large size and ampleness of frond and reticulate venation is too obvious to need elaboration.

The articulation of the stipe to the rhizome and of the pinnæ or segments to the stipe facilitate the reduction or removal of the leaf surface whenever necessary. It is thus an adaptation to life where plants must sometimes endure a more or less prolonged want of water. Like other adaptive characters, but in greater measure than many, because it involves a deeper specialization, it has a taxonomic value, as species, genera and even larger groups have developed a constant adaptation to

certain conditions. Under the conditions at San Ramon (and under tropical conditions in general), then, the characteristically epiphytic groups have articulate stipes; the characteristically terrestrial ones, non-articulate stipes. Among our Asplenieæ a single genus exists which, when mature, is always epiphytic in exposure; namely, *Stenochlæna*. Its pinnæ under these circumstances are articulate, but young plants near the ground are without articulations. Our Pterideæ include no epiphytes and no plants with structural articulations. However, there are some species of *Adiantum*, notably *A. opacum*, the pinnules of which are deciduous in an emergency. The Vittarieæ as a group are non-articulate epiphytes. To endure this condition they have thick, rolling leaves with very heavy epidermal walls and very few stomata.

The stems of the Polypodieceæ are moderately modified in adaptation to a wide range of conditions—more modified and more variously so than one might imagine from text-book comparisons with Equisetum and Lycopodium. The most primitive form of fern stem is probably a short, erect one such as is observed in *Aspidium*, *Diplazium* and *Pteris*. This may be subterranean, or barely superficial, or in damp and darker places may rise into the air, as is the case with most of the larger *Diplazia*. On trunks deeply covered with vegetation some small ferns have stems standing out radially with a dense apical tuft of small fronds. A large number of ferns lift their fronds above competition with their terrestrial neighbors by assuming the scandent habit. The majority of these maintain their connection with the ground, but are still, if we classify all ferns as either terrestrial or epiphytic, rather to be regarded as belonging to the latter class, because of their exposure. Numerous other ferns keep to the ground or to their original aërial support, but remove their leaves from competition with one another by a creeping habit and by bearing them at considerable intervals. Neither the geo-

tropism of the stem, determining whether it shall be prostrate or erect, nor its symmetry, radial or bilateral, seems to be a very deep-seated or firmly fixed character, for both change in many instances within universally recognized generic or subgeneric limits.

Fleshy rhizomes serving as water reservoirs are found in *Drynaria* and its relatives, most notably in *Polypodium heracleum* and less developed in *Photinopteris* and *Polypodium affine*. All rhizomes are protected against loss of water at the apex and many throughout their length by scales which vary in form, size and texture. Exceedingly harsh palæ are found on *Dipteris* and *Dennstædtia Williamsi*, two ferns with notably stout rhizomes. It is very probable that these are protective against animals such as deer and hogs, which are very numerous, but which never, so far as I have observed, touch these species. Similar scales protect the fleshy crowns of various Cyatheaceæ. The muricate stems of *Stenochlæna* and muricate stipes of *Dennstædtia erythrorachis* and other species probably have the same function. Dead bases of stipes must provide other rhizomes with an unpalatable mantle, but most fern stems are too hard to need protection of this kind. Many stems contain chlorophyll when exposed to light. It is regularly present in those of *Polypodium accedens, P. dolichopterum, P. commutatum* and *P. Schneideri.*

The correlation between length of rhizome and length of stipe has just been mentioned. A similar correlation exists between length of one or the other of these and the development of the lowest pinnæ. Deltoid fronds—that is, fronds with elongate lowest pinnæ—would seriously interfere with each other's light if they were not borne on wide-creeping rhizomes or on very long ascending stipes or on comparatively short but more horizontal stipes. Fronds with short stipes, unless these are very remote, usually have the pinnæ reduced toward the base. Under the same conditions, entire fronds are narrowed

below. Among tufted fronds, such forms are the rule. All the lower pinnæ are sometimes equally and extremely reduced, the largest ones being immediately above these. Such fronds are physiologically like those with long stipes and large lowest pinnæ. Fronds with broad bases which are so placed as not to overlap might lose considerable light between the stipe, but in general this space is utilized. A long, broad wing on the stipe sometimes extends the assimilating area. In many species the lowest pinnæ are deflexed forward so that they practically fill the space between the frond bases. Deltoid fronds usually reach the same end by a strong basicopic development of the lowest pinnæ. Since half the margin of the frond is longer than its axis, most pinnæ being narrowed toward their apices lose considerable space between their distal ends. This form economizes the conduction of water and food and is mechanically good because it is compact, but it involves a waste of light which is saved in *Nephrodium diversilobum* and *N. Bordeni,* which broaden toward almost truncate apices. The pinnæ, as well as the fronds of ombrophilous plants, as is to be expected, are in general fitted together so as to utilize all possible light consistent with the disposible surface. Notably perfect mosaics are presented by *Davallia solida, Dennstædtia Williamsi* and all fronds with trapezoidal or lunulate pinnæ or pinnules. The pinnæ of *Lindsaya pulchella* would overlap wastefully were they not set at such an angle that they act like a grating.

Perhaps the most interesting specialization of the roots of ferns, but one which I have seen mentioned nowhere else, is the massing of very numerous roots, all densely covered by a felt of long, brownish, persistent root-hairs which form a structure for the storage of water. Appropriate to their function, these masses of hairy roots are commonly found on ferns growing on naked rocks or tree trunks, but never on ferns with abundant soil nor on trunks laden with moss. Persistent root-hairs as

organs of attachment are very common among ferns and other plants, and it is doubtless through roots clinging by such means that these water stores have been evolved. Obviously, too, the deepest roots in every mass of this kind still fasten the plant to its support, but that more than the deepest layer in the mass, which is sometimes two centimeters thick, can serve in this way, is, of course, impossible. There is every gradation from these thick pads down to those so thin that they may serve for attachment alone, as is the case with *Polypodium macrophyllum.*

Asplenium epiphyticum has roots of two kinds: those of unlimited length, positively geotropic, forming a jacket around the stem, diarch, flanked by sclerenchyma, unbranched, with hairs along the sheltered side, and roots two or three centimeters long, slightly negatively geotropic, freely branching, closely appressed to the support, clinging by copious hairs, of similar structure to the preceding, but with more sclerenchyma. These latter are the clinging roots. The former under favorable circumstances will reach the ground and branch. *A. scandens* likewise has roots of two kinds. The bracing roots of *Nephrolepis* are very familiar objects. Those of several species of *Diplazium* are very stiff and somewhat spreading above the ground.

The principles underlying the adaptations of the reproductive structures of ferns are very simple. The sporangia must be protected during their development against injury by dessication or otherwise; the mature spores must dry thoroughly enough to be easily and well scattered, and the drying of the spore must not involve too great a dessication of the frond. The structures found in ferns are a compromise between these rather antagonistic principles. Ferns almost always protect their sporangia at the same time that they avoid interference with the illumination of the assimilating organs by restricting the former to the nether surface of

the frond. Our physiological exceptions are *Psomiocarpa* and *Stenosemia,* the vegetative and reproductive fronds of which are distinct, and *Lecanopteris,* which may not be entirely dependent upon photosynthesis for its organic food. For the sake of facile nutrition and to preserve the normal exercise of its functions by the nether epidermis, the sporangia of practically all ferns whose vegetative and reproductive fronds are alike are collected into sori. Most ferns protect their sori by means of indusia. At San Ramon, sixty per cent. of all the Polypodiaceæ have indusia, the remaining forty per cent. including thirteen members of the old genus *Acrostichum* and a number formerly put in *Gymnogramme,* besides all those with well-defined nude sori. Any full discussion of the forms and origin of indusia would be superfluous here in view of the attention they have received as most important structures in taxonomy, but it is pertinent to the subject of this work to point out that their structure fits the local demands upon it. Thus, it is leathery in the two strongly marked xerophytic genera, *Davallia* and *Humata,* but not in their mesophytic relatives. In *Asplenium* it is the xerophytic section with fronds which has by far the firmest indusia.

A heavy coating of hairs protects the sori as well as the stomata against undue loss of water in *Niphobolus lingua* and various congeners. While the function of paraphyses in general is to protect against water rather than dessication, there are some ferns, the paraphases of which cover the sporangia so thoroughly that they must serve in their time in both ways. The protection of the sorus by the folding backward of the margin of the frond is familiar to all in the indusia of most Pterideæ. The same effect is reached very thoroughly by two of our species of *Polypodium—P. cucullatum* and *P. gracillimum*—which have one-half of each pinna wholly or partly folded backward against the other half, covering the single sorus. In *Acrosorus* the folding is com-

plete and permanent, the edge being grown fast and the sorus opening toward the apex. Numerous ferns protect their young sori by more or less completely sinking them below the level of the frond's surface. According to the extent of the immersion and the thickness of the frond, the spots occupied by the sori may or may not be prominent on the upper surface of the frond. When they make moderately convex spots it strengthens the frond mechanically, so that the fertile part of the frond of *Nephrodium Foxii* retains its form for some time after the sterile part has begun to wilt. In *Monogramma* and *Vittaria* the sori are in deep slits, the effect being as in *Asplenium phyllitidis,* but the protection of the more open slits is perfected by capitate paraphyses. In *Polypodium incurvum,* and more prominently in *P. subauriculatum, P. nigrescens, P. schneideri* and *P. papillosum,* the sori are immersed for several times the thickness of the frond, forming very prominent projections from the upper surface.

The structures that serve to prevent the dessication of young sori serve also, without exception, to make their exposure to liquid water impossible, and there are a considerable number of ways in which they are adapted to perform this latter function well. In other cases, structures at first clearly protective are done away with or changed in such a way that as to make the mature sporangia as exposed as possible. Thus in a large part of our *Nephrodiums* and in many of their relatives the indusia partly or completely disappear as the sporangia mature. In *Asplenium scandens* and without doubt in many other species the indusia are motile, bending outward when dry, but closely appressed when wet. This movement deserves careful study both as to its commonness and its mechanism. I have noticed it to exist, but in a less pronounced manner, in *Onychium.* The indusia are beset with hairs which I interpret as water-repellent structures in various *Nephrodiums,* and are glandular hairy or glandular ciliate in others.

It has already been stated that paraphyses are in general water-repellent structures, in adaptation to which function they are provided with oily heads. The paraphyses are in part a substitute for indusia and often occur on ferns such as Acrosticheæ, which could not have indusia, but they are not rarely present in indusiate sori. They are notably developed on *Lomagramma* and *Acrostichum,* the brown color of the surface of the latter being due to them, while the sporangia are green. The branched form, like the oiliness, is evidence that they are specialized for protection against water rather than against dessication. Hairs on the end of the sporangia have the same effect. They are found in a number of species of *Nephrodium,* such as *N. setigerum* (glandular) and *N. diversilobum.* These hairs on the ends of the sporangia make the whole sorus incapable of being wet. Spores of ferns in general are not readily wet, because of their waxy and often rough or reticulate surfaces. Their resistance to wetting not merely facilitates their dispersal but insures them against germination under too temporarily favorable circumstances.

Very numerous ferns provide in a variety of ways that the dryness necessary for the dispersal of the spores shall involve the least possible dessication to the vegetative frond. One very simple means to this end is the location of the sori on the margin, or even on teeth. The marginal or apical position of the sori has been assumed independently by the plants in many different groups of ferns. As the primary purpose of this position of the sori is to insure the dryness of the sporangia and spores, it is characteristic of the plants growing in the most moisture-laden atmosphere, as in the rain- and mossy-forests. The tooth position is obviously drier than the merely marginal. The *Lindsayas* growing in the moistest places are deeply cut—even finely dissected in *L. Blumeana* of the mossy forest of Luzon. Yapp suggests that the peculiarly placed sori of *Lecanopteris* will let the spores escape only when there is wind enough to be

likely to scatter them into such places as the plant normally occupies, which are in the crowns of lofty trees.

It is probable that a considerable majority of all ferns have the fructification developed toward the apex rather than toward the base of the frond, obviously favoring the greater dryness of the fertile region. There are all grades of specialization in this respect from that in which the preference of the sori for the distal end is doubtful or not, emphasized as in the case of many species of *Nephrodium, Polypodium,* etc. The adequate drying of the mature reproductive structures without jeopardy to the proper performance of the vegetative functions is accomplished in many ferns by the specialization of entire fronds for one or the other end. In many ferns there is little or no specialization other than a difference in the length of the stipes, those of the fertile frond being the longer. In *Pteris* there is a difference in the margin, and in *P. ensifolia* the fertile frond is less compound than the sterile. The fertile fronds of *Polypodium sinuosum* yield to drought and fall off before the sterile.

There still remain a few ferns in which the differentiation has gone so far that the assimilating but not the spore-bearing surface of the frond has been practically obliterated. These are *Leptochilus* and *Cheiropleuria,* still with some expansion of green lamina, the nether surface of which is completely covered, when mature, with sporangia; *Blechnum egregium,* the fertile pinnæ of which are expanded at the base only, and *Psomiocarpa, Stenosemia, Stenochlæna* and *Lomagramma,* whose fertile fronds are almost completely without assimilating tissue. The two scandent genera have the pinnæ articulated to the rachis and the pinnæ of the fertile fronds of both are much more caducous than those of the sterile. This, with the further fact that only plants of a very considerable age are fertile, makes fertile fronds of both hard to find. The fertile frond of *Blechnum egregium* as well seems to be both rare and transitory, and on all these ferns they are to be found only in season.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(Continued)

POLYPODIUM. L.

167. **Polypodium angustifolium** Sw. Rare; on the trunks of trees. Southern Florida; also in the American Tropics. The form **ensifolium** (Willd). (*Polypodium ensifolium* Willd) is a narrower form reported with the type.—*Campyloneuron angustifolium* (Sw.)

168. **Polypodium aureum** L. GOLDEN POLYPODY. HARE'S FOOT FERN. Common; on palmettoes, occasionally on the ground. Southern Florida; also in the American Tropics.—*Phlebodium aureum* (L.)

169. **Polypodium Californicum** Kaulf. Common; in the crevices of rocks. California; also in Mexico and Central America. The form **intermedia** H. & A. is found with the type and approches *P. vulgare* in appearance.

170. **Polypodium costatum** Kunze. Rare; in rocky shades. Southern Florida; also in Jamaica and Central America.—*Campyloneuron costatum* (Kuntze.)

171. **Polypodium falcatum** Kellogg. LIQUORICE FERN. Common; on old logs and the base of trees, occasionally in soil in damp, shady places. California to Alaska.—*P. Glycerrhiza* D. C. Eaton; *P. occidentale* (Hook.)

172. **Polypodium hesperium** Maxon. Not uncommon; in rocky shades. Arizona to Montana and British Columbia.

173. **Polypodium incanum** Sw. GRAY POLYPODY;

Resurrection Fern. Common; on the large branches of trees or in rocky soil. Virginia, Ohio, Iowa and Kansas, south to the Gulf; also in the West Indies, Central America and southward to Chili and Argentinia and in South Africa.—*Polypodium polypodioides* (L); *Marginaria polypodioides* (L.)

174. **Polypodium latum** (Moore) Rare; in woods. Southern Florida; also in the American Tropics.—*Campyloneuron latum* Moore.

175. **Polypodium pectinatum** L. Rare; in rocky shades. Southern Florida, also in the American Tropics.

176. **Polypodium phyllitidis** L. Not uncommon; in rocky woods. Florida; also in tropical America.—*Campyloneuron phyllitidis* (L.)

177. **Polypodium plumula** H. B. K. Rare; in woods. Southern Florida; also in tropical America.

178. **Polypodium Scouleri** H. & G. Rare; on trunks of trees or occasionally on rocks, near the coast. California to British Columbia.

179. **Polypodium Swartzii** Baker. Rare; on the branches of trees. Southern Florida; also in the West Indies and south to Brazil.—*Phymatodes Swartzii* (Baker); *Phymatodes exiguum* (Hew.)

180. **Polypodium thysanolepis** A. Br. Rare; in stony open ground Arizona; also in the West Indies and southward through Central America to Peru.

181. **Polypdium vulgare** L. Common Polypody. Abundant on shaded rocks. Throughout North America except in the coastal plain of

the Gulf States; also in Europe, Asia, China, Japan and South Africa.

Ecological and monstrous forms of this species have been named **alato-multifidum, attenuatum, bifido-multifidum, Cambricum, Churchiae, Columbianum, deltoideum, hastatum, marginale, multifidum, platylobum, ramosum, rotundatum, semi-lacerum,** and **sinuatum.** The form *Cambricum* is the Welsh polypody and forma *rotundatum* has round-ended pinnules. Any of these forms are likely to occur with the type. They are described in the Fern Bulletin XIV, 33, 1906.

182. **Polypodium vulgare angustum** Muell. Not common; on shaded rocks. In the Alleghenies from New York to Virginia.—*Polypodium vulgare deceptum* Maxon; *P. v. biserratum* Millspaugh; *P. v. acuminatum* Gilbert; *P. v. oreophilum* Maxon.

POLYSTICHUM Roth.

183. **Polystichum acrostichoides** Michx. CHRISTMAS FERN. SHIELD FERN. Abundant; especially in moist, rocky woodlands. Nova Scotia and New Brunswick to Wisconsin, Iowa and south to the Gulf States.—*Aspidium acrostichoides* Sw.; *Dryopteris acrostichoides* Kuntze.

The form **crispa,** Clute is a wavy-leaved form occurring with the type; **f. incisum** A Gray (*P. acrostichoides Schweinitzii* Beck) is an incised form also likely to occur. **f. multifida** Clute is a form with deeply divided pinnules reported from Connecticut, New York and New Jersey; **f. recurvatum** Clute has the pinnules recurved and the margins reflexed. It

has been reported from Connecticut and Virginia.

184. **Polystichum aculeatum** (L.) PRICKLY SHIELD FERN. Common; in rocky woods and slopes. California and Oregon to Washington; also nearly throughout the world in temperate and tropical regions. Extremely variable in the cutting of the fronds and thus giving rise to many varieties. More than forty have been catalogued.—*Aspidium aculeatum* Sw.; *Dryopteris aculeata* Kuntze.

The American forms **angulare** Presl; **Californica** D. C. Eaton, and **lobatum** Ait. are likely to be found with the type.

185. **Polystichum aculeatum Braunii** (Spenner) Not uncommon; in moist shaded woods. Maine, New Hampshire, Pennsylvania, Michigan and Washington northward; also in Europe, Asia and the Hawaiian Islands.—*Aspidium aculeatum Braunii* (Spenner); *Dryopteris aculeata* Kuntze. *Polystichum Braunii* (Spenner)

186. **Polystichum aculeatum scopulinum** (D. C. Eaton.) Not uncommon; in rocky places. California and Arizona northward to Washington and Idaho and in Quebec.—*Aspidium aculeatum scopulinum* D. C. Eaton.; *Polystichum scopulinum* (D. C. Eaton.)

187. **Polystichum Lemmoni** Underw. Rare; Northern California to Washington. Reported by D. C. Eaton to be identical with *Polystichum mohriodes* Bory from South America and until recently listed under this name.

188. **Polystichum lonchitis** (L.) HOLLY FERN. Common; in rocky woods. Nova Scotia, Wis-

consin and Washington northward and in the mountains of Utah, Colorado and California; also in Northern and central Europe, Asia and in the Himalyas.—*Aspidium lonchitis* Sw. *Dryopteris lonchitis* Kuntze.

189. **Polystichum munitum** (Kaulf.) Common; on stony slopes. California and Arizona to Alaska.—*Aspidium munitum* Kaulf; *Dryopteris munita* Kze.

The form **imbricans** D. C. Eaton with close-set pinnae, the form **inciso-serratum** D. C. Eaton with deeply cut pinnae and **f. flabellatum** A. A. Eaton with forked fronds may be expected with the type.

PTERIS L.

190. **Pteris aquilina** L. BRACKEN; BRAKE. EAGLE FERN. Abundant in woodlands, pastures and along roadsides. Throughout most of the known world. The form **crispa** Wollaston is reported from Massachusetts.—*Pteridium aquilinum* (L.)

191. **Pteris aquilina pseudocaudatu** Clute. SLENDER BRACKEN. Common or abundant; in sterile soil. Long Island to Texas mostly in the coastal plain. Until recently confused with *Pteris caudata* L.—*Pteridium aquilinum pseudocaudatum* Clute; *P. latisuscula* Desv.?

192. **Pteris aquilina pubescens** Underw. Common; in situations preferred by the type. Arizona to British Columbia.—*Pteris aquilina lanuginosa* Underw.

193. **Pteris caudata** L. Somewhat rare; in open places. Southern Florida; also nearly around the world in the tropics.

194. **Pteris cretica** L. Rare; on banks and walls. Georgia and Southern Florida; also around the world in the tropics.

195. **Pteris longifolia** L. Long-leaved Bracken. Common; on walls and rocky banks. Florida Alabama and Louisiana near the Gulf; also throughout the tropics.

196. **Pteris serrulata** L. f. Saw-leaved Bracken. Common on old walls. South Carolina to Louisiana and Florida, mostly near the coast; also in China and Japan. According to Christiansen, this is properly *Pteris multifida* Poir.

Scolopendrium J. E. Smith.

197. **Scolopendrium vulgare** J. E. Smith. Hart's-tongue Fern. Rare and local; in moist ravines and rocky woodlands. New Brunswick, Ontario, Central New York and Tennessee; also in Europe, Asia Minor, Persia, Japan and Mexico. *Phyllitis scolopendrium* (L.); *Scolopendrium scolopendrium* (L.)

Struthiopteris Willd.

198. **Struthiopteris Germanica** Willd. Ostrich Fern. Common or abundant; in moist shades, especially along streams. Nova Scotia to Virginia, Iowa and British Columbia; also in northern and central Europe and in Asia. The form **pubescens** Terry is reported from Connecticut. —*Onoclea Struthiopteris* Hoffm.; *Matteuccia struthiopteris* (L.)

Taenitis Sw.

199. **Taenitis lanceolata** (L.) Not common; on the trunks of trees. Florida; also in the West Indies, Guiana and Guatemala.—*Cheilogramma*

lanceolata (L.); *Paltonium lanccolatum* (L.)

VITTARIA Smith.

200. **Vittaria lineata** (L.) GRASS FERN. Not uncommon; on the trunks and branches of trees. Southern and central Florida; also in the West Indies and tropical America.

WOODSIA R. Br.

201. **Woodsia glabella** R. Br. Somewhat rare; on rocks. New Brunswick, Vermont, New York and British Columbia northward; also in northern Europe and Asia.

202. **Woodsia hyperborea** (R. Br.) Rare; on rocks. Maine, Vermont, New York and Ontario to Alaska and Greenland; also in northern Europe and Asia and in the Himalayas.—*Woodsia alpina* (Bolton.)

203. **Woodsia Ilvensis** (L.). RUSTY WOODSIA Common; on exposed trap rock. North Carolina, Kentucky and Iowa to the far north; also in Greenland and northern Europe and the mountains of Asia.

204. **Woodsia Mexicana** Fee. Rare; in rocky shades. Texas, New Mexico and Arizona; also in Mexico.

205. **Woodsia obtusa** (Spreng.) COMMON WOODSIA. Common or abundant; on shaded rocks and in woodlands. Georgia, Alabama and Texas to Alaska and Labrador; also in Peru. The form **angusta** Peck and **f. nana** Lemmon may be expected with the type.

206. **Woodsia obtusa glandulosa** D. C. Eaton. New Mexico and Arizona.—*Woodsia obtusa Plummerae* Lemmon.

207. **Woodsia Oregana** D. C. Eaton. Somewhat rare; in rocky soil. Northern Michigan, Wisconsin, Oklahoma, Arizona and California to British Columbia and Northward.

208. **Woodsia scopulina** D. C. Eaton. Rare; on rocks. Ontario and Michigan to British Columbia and Alaska; also in the mountains of Arizona and California.

The form found in Michigan and Minnesota has been described as *W. Cathcartiana* Robinson. It differs only in the form of pubescence and is more properly **Woodsia scopulina Cathcartiana.** (Robinson.)

WOODWARDIA Smith.

209. **Woodwardia angustifolia** J. E. Smith. NARROW-LEAVED CHAIN-FERN. Common in shaded marshes near the coast. Maine to Florida, Texas and Arkansas; also in Michigan.—*Lorinsera areolata* (L.); *Woodwardia areolata* (L.).

210. **Woodwardia spinulosa** Mart & Gal. Rare; in moist places. Arizona, California and Washington. The form **ramosa** A. A. Eaton is reported from California. This species is often considered a form of *W. radicans.*

211. **Woodwardia Virginica** (L.) COMMON CHAIN-FERN. Abundant in open swamps. Nova Scotia, Ontario and Michigan to Arkansas, Louisiana and Florida; also in Bermuda. A small form is reported from South Carolina as **f. thelyteroides** Pursh.—*Anchistea Virginica* (L.)

EDITORIAL

In honor of the completion of fifteen volumes of this magazine, and at the solicitation of numerous subscribers, the editor has been led to use his portrait as a frontispiece in this issue. Our critics may now observe how fifteen years of fighting for a sane nomenclature and a reasonable interpretation of the species concept has furrowed the editorial brow, silvered his raven locks, and put a general crimp into his ambition to make everybody interested in ferns. But even a careful look at the features presented will fail to discover any inclination to give up the fight.. As an additional contribution, the editor has autographed the copies intended for subscribers. Anybody who prefers a plain copy may exchange his autographed copy for it, and those who do not get an autographed copy may have one by returning the regular copy, and requesting it.

* * *

In this issue we reprint an extended article on the ecology of some tropical ferns which we think our readers will find worth a careful reading. The ways in which ferns have adjusted themselves to their position in life must ever be of absorbing interest to all who are not mere fern collectors. Considerable pleasure may be gained by an investigation of our own ferns in the light which this article throws upon them. Touching this subject, however, it may be said in passing that the subject of plant ecology is still so new that it is quite possible that many of the deductions thus far made may not hold when further evidence is forthcoming. The article is one that should stimulate thought and experiment among our own fern students, with a view to proving or disproving the ideas held at present.

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CONTENTS.

PAGE

American Fern Society.....32, 63, 96, 128
An Abnormal Cinnamon Fern—*Willard N. Clute*.107
A New Fern From the United States—*Willard N. Clute* 1
Asplenium ebenoides in New York—*Stewart H. Burnham* 111
Asplenium Trichomanes x Ruta-muraria—*Willard N. Clute*..... 46
Book News.....31, 94
Botrychium, Fruiting of—*Mrs. A. E. Scoullar*.... 84
Bracken, A Pedate—*Willard N. Clute*..... 33
But Half a Fern—*Willard N. Clute*..... 5
Check-list of the North American Fernworts—*Willard N. Clute*.....16, 51, 81
Cheilanthes Parishii, Rediscovery of—*C. F. Saunders* 35
Crest Fern, A Cut-leaved—*Willard N. Clute*..... 12
Cystopteris, A Slender Leaved—*Willard N. Clute* 75
Dimorphic Fronds, On Changes of Function in—*Willard N. Clute*..... 65
Eaton, Alvah A., Death of.....109
Editorial.....28, 60, 92, 124
Equisetum hyemale, Notes on—*Chas. C. Plitt*....113
Families of Fern-like Plants—*D. C. E. Bessey*... 70
Fern, But Half a—*Willard N. Clute*..... 5
Ferns of Bloomington, Indiana—*F. C. Greene*.... 68
Ferns of the Upper Susquehanna Valley—*George F. Cleveland*.....101
Florida Fern, New Station for a Rare—*Willard N. Clute* 38
Hybrid Ferns, Notes on Some—*Margaret Slosson*. 97
Index to Recent Literature.....26, 58, 89, 122
Lycopodium Lucidulum Porophilum in Ohio—*Almon N. Rood*.....105
Nephrodium Patens and Nephrodium Molle—*Willard N. Clute*..... 49

PAGE

Nephrodium Simultatum, Observations on—*J. C. Buchheister* 104
New Station for a Rare Florida Fern—*Willard N. Clute* 38
New Zealand Ferns, On Some—*Willard N. Clute* 42
Nomenclature, A Question of—*A. A. Eaton*..... 77
Ostrich Fern, A New Variety of—*William A. Terry* 3
Ostrich Fern, var Pubescens—*A. A. Eaton*..... 47
Polypodium, The Grass-like—*Willard N. Clute*... 99
Polypodium vulgare Auritum—*H. W. Jewell*.... 85
Polystichum Acrostichoides x Angulare—*Amedee Hans* 15
Rare Forms of Ferns.....12, 46, 75, 107
Solar Prints of Plants—*James Shepard*..... 39

PTERIDOGRAPHIA:

Botrychium dichronum..... 119
Botrychium Lunaria..... 117
Brake, The Common, as Food..... 86
Cliff-brake, Slender, in Japan..... 117
Death of Mrs. Horton..... 57
Fern Genera 88
Fern Names, Changes in..... 120
Food Preservers, Ferns as..... 87
Genera, Fern..... 88
Generic Relationships 25
Lomaria Spicant's Variable Sporelings.....117
Nomenclature, Some Curious..... 119
Ohio, Ferns of..... 121
Ophioglossum, Development of..... 24
Osmunda, Fall Fruiting of..... 121
Polypody, A New Form of..... 91
Polystichum acrostichoides recurvatum..... 15
Spores, Light and Germination of 24
Woodsia Oregana 106

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The Fern Bulletin

A Quarterly Devoted to Ferns

January

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1908

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

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ASPLENIUM FERRISSI.

THREE-FOURTHS NATURAL SIZE.

THE FERN BULLETIN

Vol. XVI JANUARY, 1908 No. 1

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A NEW FERN FROM THE UNITED STATES.

By Willard N. Clute.

Collectors of the ferns have so carefully explored every easily accessible part of the United States, that a new fern is a rarity, indeed, and only to be found by penetrating beyond the bounds of even frontier civilization. The opinion has often been expressed in these pages, however, that the southern parts of our territory would still yield several more ferns that were either new to science or new to the United States, and this opinion has recently been substantiated by the finding in southern Florida of various species new to our flora. It is probable that other species will eventually come to light in that state, as the exploration of unsettled parts continues.

A second region from which we may expect additional species from time to time is that part of the United States which borders Mexico. In the past several unique species have been reported from the canyons of New Mexico and Arizona and the recent trip to that region made by Mr. James H. Ferriss, has resulted in the discovery of various new forms. One of these is so unlike anything I have been able to find described, that I venture to name it a new species as follows:

Asplenium Ferrissi sp. nov.

Rootstock small, erect; fronds oblong-lanceolate, short-stalked, spreading, 8 to 15 cm. in length; 2 to

MAR 9 - 1908

4 cm. in width, tapering from above the middle to the base, thickish, dull green in color, nearly pinnate below, pinnatified in the upper portion; divisions of the blade alternate, spreading or ascending, rounded in small fronds, longer and obtuse in larger ones, the margins entire or wavy; sori, heavy, elongated, 5 to 10 on a segment, the basal ones nearly parallel to the midrib: Indusium thin, nearly disappearing in old fronds, veins free, one to three times forked.

Habitat: Under dryish shelving rocks between Brown and Tanner's Canyons, Huachuca mountains, Cochise County, Arizona. Collected October, 1907 by James H. Ferriss, for whom I take pleasure in naming the species. Type in my own herbarium.

The locality in which the plant was found is about five miles from conservatory (Ramsey) Canyon in the direction of Fort Huachuca and six miles or more from the Mexican boundary. It was growing in locations similar to those selected by *Aspidum juglandifolium* and *Polystichum aculeatum lobatum.*

The plants have a passing resemblance to *Asplenium cbeneum* but could not be mistaken for it even by a novice. The stipes and midrib are greenish, the pinnules broad and in the upper part of the frond the sinuses between them are from 3 to 5 millimeters from the midrib. The long and heavy sori and the spreading habit of even the fertile fronds are especially characteristic. Young forms of this species have undivided elliptical fronds. About 75 specimens of this plant are at present growing in cultivation in Joliet, Illinois.

A NEW VARIETY OF THE OSTRICH FERN.

By William A. Terry.

Somewhere about twenty years ago, I commenced growing a complete collection of the native ferns of this section in my home grounds. I wished to become familiar with all their peculiarities through the entire season and decide from their variations which were really the typical forms of the species. I also hoped to give protection to rare species that were threatened with extinction. As there were some six or eight species that I did not find in Bristol I applied to several botanical friends for information as to localities where they might be found. The late James N. Bishop of Plainville gave me two stations for the ostrich fern, Goldie's fern and the purple cliff-brake in Plainville. I had previously known of abundant colonies of climbing fern near the same place. Mr. James Shepard showed me several small colonies of the walking fern and gave me a new station for the climbing fern in Plainville. Mr. Lumen Andrews of Southington gave me a station for the oak fern, Goldie's fern and the chain fern (*Woodwardia virginica*) in Southington. Some years later, Bishop told me of a new find, a remarkable colony of *Woodwardia angustifolia* in the town of Orange. I afterwards found this abundant in South Haven.

Bishop's colony of the ostrich fern was quite large. Some hundreds of the plants were growing in the open in direct sunlight. These were all large clumps. In the woods many of them were smaller and on the border were many quite small and detached, evidently grown from spores. To make sure of success, I took plants, both large and small as I had known of several instances in which plants moved failed to grow. All

my plants lived and grew although it took several years for them to become used to the change and show their natural vigorous growth. One small plant had both stipe and rachis densely covered with a downy white pubescence and in after explorations I saw others with the same peculiarity. In exploring the neighborhood of Bishop's find of *Asplenium* I found other colonies and one of the ostrich fern with many plants, all of which appeared to me to be the pubescent variety, but as at the time I took no particular interest in this variety I did not give them the close examination that I should have done.

In my principal fern bed this pubescent form has increased in numbers to some eight strong plants. The pubescence is so strongly marked as to be visible at several rods distance and persists throughout the season. The common variety grows here about six feet high, many of the fronds measuring six feet four inches long, while the pubescent form growing among them is scarcely four feet high and the fronds are drooping like those of Clayton's fern (*Osmunda Claytoniana*) instead of upright and the stipe is slenderer. The common form fruits abundantly, each plant having from three to eight fertile fronds, while the pubescent form has never fruited at all. I hope that in the coming season I shall be able to give the wild plants of this variety a more careful examination.

Bristol, Conn.

[The editor of this magazine has known of Mr. Terry's plants for some time and can add that they seem very distinct from the others so far as outward appearances go. Neither of us have any idea that the pubescent plants comprise a new spe-

cies, but since it is desirable that these variations from the normal have a name to distinguish them, we may adopt for this one the name of *pubescens* which Mr. Terry has suggested in correspondence regarding it. —Ed.]

BUT HALF A FERN.

By Willard N. Clute.

Twice in the life-cycle of the ferns, each plant is reduced to a single cell. The best-known of these reductions is that in which the spores are produced on the backs of the fronds, the other occurs on the prothallium at the time when the new fern plant arises. It is this second cell that really produces the fern plant, although it is commonly believed that the spores found on the backs of the fronds are the ones that do so. These latter spores, called *asexual* spores because they are not connected in any way with sexual processes, are formed by the interior division of a cell and merely produce the prothallium. It is only in exceptional cases, to be mentioned later, that a new fern-plant originates without the prothallium first forming a special *sexual* cell or spore. In fact, the two kinds of spores divide the life of the fern into two distinct generations which alternate with each other, a prothallium being first formed by the asexual spore and this being followed by the production of a new fern plant by a sexual cell in the prothallium. The sexual cell is formed by the union of two other cells, usually called *gametes* and the prothallium is therefore often known as the *gametophyte,* while the fern plant producing the asexual spores is called the *sporophyte.* The fact that all the fernworts consist of two distinct gen-

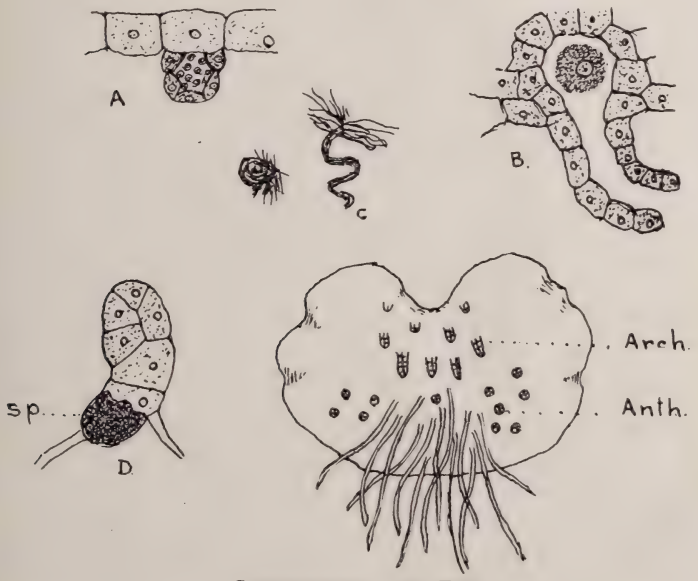
erations that alternate with each other cannot be too strongly emphasized. The fern-plant as commonly recognized, therefore, is but half a fern. It is the other and less familiar half that we purpose considering in this article.

When an asexual spore from one of the sporangia on the back of a fern frond falls in a place suitable for germination, it begins to grow, forming new cells by the repeated division of the original one. Soon, there is formed a flat, green, scale-like object, usually heart-shaped and approximately a quarter of an inch in diameter. This is the prothallium of gametophyte. It is attached to the soil by slender, hair-like structures, called *rhizoids* by means of which it absorbs the moisture that, together with the carbon-dioxide of the air, forms its food materials. The building of the food is carried on by certain small bodies in the cells, called *chloroplasts,* which derive their energy from sunlight by means of the green coloring matter of plants or *chlorophyll.* The gametophyte of the grape-ferns (*Botrychium*), the adder'stongues (*Ophioglossum*) and various club-mosses (*Lycopodium*), lack this green color, and cannot alone form their own food. They have therefore gone into partnership with various minute fungi in order to secure a living.

As the development of the gametophyte proceeds, there begin to appear upon the older parts certain small structures called *antheridia.* These are borne on the under side of the plant and, at maturity, consist of three or more cells enclosing a number of male gametes called *sperms.* The sperms are slender, ribbon-like objects, coiled cork-screw fashion and furnished near one end with numerous hair-like *cilia.*

If the gametophyte happens to have difficulty in se-

curing a plentiful supply of food, it may develop only antheridia, but if well nourished, *archegonia* may begin to appear a short time after the antheridia, and upon the same side of the prothallium. The two kinds of organs are rarely, if ever, intermingled, the archegonia always appearing on the younger parts, near



GAMETOPHITE OF THE FERN.

A—The antheridium containing sperms. B—The archegonium. C—The sperms. D—A very young prothallium. sp.—The spore. All much enlarged.

the notch which gives the heart-shaped outline to the gametophyte.

The archegonia, like the antheridia consist of several cells and in the base of each is developed a single cell called the *egg*. When the egg is mature, the central cells in the neck of the archegonium break down and disappear, leaving a channel from the outside

down to the egg. About this time the antheridia burst, liberating the sperms which by rapid motions of their cilia swim through the dew-like moisture on the gametophyte until they reach the archegonium, being attracted in that direction by malic and other acids which it secretes. Arived at the archegonium the sperms swim down through the neck and one at last fuses with the egg thus forming the sexual spore from which the new plant is to come.

Although numerous archegonia are usually formed on each gametophyte various conditions combine to prevent the fertilization of more than one egg and in consequence the gametophyte rarely produces more than a single fern-plant. It is interesting to note that while the sex-organs are normally borne on the underside of the gametophyte, this appears to be due largely to the light for if the gametophyte be brightly illuminated from below, it will produce the sex-organs on the darker upper surface.

A thorough understanding of the processes that lead up to the formation of the sexual spore is necessary for the intelligent hybridizing of ferns. The only way that two different species can be crossed is by causing the sperm of one to unite with the eggs of another. A chance cross may result when the spores of two different kinds are sown thickly together but the crossing may be brought about more certainly by sectioning the prothallia with a sharp knife in such a way that each piece shall have but a single kind of sex-organ upon it. Then, by planting a section of one with archegonia close to another with antheridia, a cross is practically certain. The only difficulty in the way is the small size of the prothallia which makes proper sectioning a delicate matter. All natural hy-

brids, of course, have originated in the first way and it is a matter of wonder that a greater number of natural hybrids have not been recorded since the possibilities are in favor of it. In species like *Equisetum,* in which the gametophytes are dioecious, that is, each produces but one kind of sex-organ, fertilization of the egg by sperms from another gametophyte is the natural course.

In rare cases the gametophyte may omit the formation of a fern-plant by means of a sexual spore and produce a new fern-plant directly from a bud. This is known as *apogamy.* In some species the gametophyte thus give rise to several branches, each of which may produce a new plant or penetrating the soil, form tuber-like growths from which new plants subsequently spring.

When the sexual cell or spore begins to grow, it increases in size by the repeated division of the original cell just as the asexual spore does, but unlike that spore , it does not fall from the plant. From one section arises the first leaf, from another the stem, from another the first root and from the last an organ called the *foot* by means of which the young sporophyte absorbs food from the gametophyte until it is able to get food for itself. Some of the structures developed by the new sporophyte mark a long step in the evolution of the fern and serve to sharply disguish them from plants lower in the scale of life. For instance, the ferns are the first plants to have true roots. The mosses, to which the ferns are near allied produce rhizoids as the fern gametophyte does, but never roots. Again, the moss gametophyte may be leafy while the sporophyte never is; in the ferns this is exactly turned around for here it is the sporophyte that is leafy and the gametophyte not.

The name frond was early given to the leaves of ferns and will probably always be used in designating these structures, but strictly scientific botanists are inclined to divide them into two groups according to the work they perform. Thus the ordinary leaves are called such while those which bear the asexual spores are known as *sporphylls.* In the ferns the sporophylls are usually very much like the leaves in appearance, but among the fern allies may be seen a gradual differentiation between them until in such plants as the *Lycopodium*s and *Selaginellas* the sporophylls are set apart for the work of spore-production while the leaves are devoted to purely vegetative functions. In *Lycopodium* the sporophylls are borne at the tip of a branch, forming the familiar spike, and each sporophyll produces the same kind of spores. In *Selaginella,* however, there are two sizes of spores, the smaller being borne in the axils of sporophylls near the tip of the spikes, while the larger are borne on the sporophylls below them. The sporophylls bearing the large spores are the *megasporophylls* and the other are *microsporophylls,* the sporangia that enclose the spores being known as *megasporangia* and *microsporangia,* respectively. This condition also exists in *Isoetes,* but in *Marsilia,* where there are two sizes of spores, both are borne on the same sporophyll which is folded up, somewhat like the pinnules of *Onoclea,* forming a *sporocarp.*

It is often asserted that the sex-organs of the prothallium are homologous with the stamens and carpels of flowering plants, but from the foregoing it may be seen that this it not correct for the pollen grain is really a spore. The stamens and carpels have their counterparts among the ferns it is true, but it is among

the parts of the sporophyte and not the gametophyte that we shall find them. The fact is, the microsporophylls of *Selaginella* are practically identical with the stamens of flowering plants while the megasporophylls with their megaspores correspond closely with the carpels and their embryo sacs. If, as we are warranted in doing, we define a flower as a cluster of megasporophylls and microsporophylls, then we can say with truth that some of the fernworts actually bear flowers.

The microspores of *Selaginella* always produce small prothallia that bear only antheridia while the megraspores give rise to prothallia that bear only archegonia. These latter, which we may call female gametophytes are not green like the gametophytes of the ferns but are colorless and therefore dependent as regards their food. The food they use is stored in the megaspore by the sporophyte. The gametophytes of this kind never get entirely out of the spore-coats, but by the splitting of these coats at maturity the archegonia are exposed for the fertilization of the egg. The new sporophyte begins to grow while yet the gametophyte is attached to the old sporophyte and thus very much resembles a seed pointing clearly to the fact that while on the one hand the fernworts are the nearest relatives of the mosses, on the other they approach very close to flowering plants.

In a few instances, the fern sporophyte has been found to produce new gametophytes without the intervention of an asexual spore, just as the gametophyte may produce a new sporophyte without the intervention of a sexual spore. This process is known as *apospory* and was first noted by Chas. T. Druery. There are two types of apospory: in one the prothallia spring from what would ordinarily be a sporangium and are,

after all, rather spore-like in origin; in the other they grow from some marginal cell of the frond. Apospory must not, however, be confused with ordinary reproduction by adventitious buds, such as may be seen on the walking fern and many others. Of the same general nature are the bulblets of *Cystopteris bulbifera* and *Lycopodium lucidulum*. The stolons of the ostrich fern, the bracken and the sword ferns are mere branches that rooting at their tips, form new plants.

RARE FORMS OF FERNS.—VI.

A Cut-Leaved Crest Fern.

The description which D. C. Eaton drew up for the form of *Nephrodium cristatum* which he named *Clintonianum* neither fits his illustration of that form nor agrees with the specimens that have subsequently been referred to it. He describes the pinnules as "linear-oblong, obtuse, serrate or cut-toothed, the basal ones sometimes pinnately lobed." It is rare, indeed, to find specimens with the cutting of the pinnules extending beyond what would be pronounced serrate while in many specimens the outline can hardly be characterized by any word that suggests a tooth-like edge. In some handsome specimens which Mr. W. A. Poyser recently sent me for examination, however, the description is fully met for in these the pinnules certainly are well described as cut-toothed. As will be seen from our illustration of a single middle pinna the cutting follows the general rule for such features and consists in a deepening into lobes of the serratures that are found on normal pinnae. The effect upon the appearance of the whole frond is to give it a very striking and beautiful outline.

Since it is desirable to have a name to characterize

this extreme form, which stands in much the same relation to *N. cristatum* that *Asplenium ebenium serratum* does to the type, Mr. Poyser sends the following description:

NEPHRODIUM CRISTATUM CLINTONIANUM f. SILVATICUM f. nov.

Rootstock as in the type: fronds averaging as large as the sub-species; pinnae long-stalked, broader than in the normal form, as wide at base as in the middle:

PINNA OF NEPHRODIUM CRISTATUM CLINTONIANUM SILVATICUM POYSER.

pinnules distant, linear-oblong, sharp-pointed, deeply serrate or toothed, the teeth often serrulate.

Found in Delaware County, Pennsylvania. Type No. 534 in the herbarium of W. A. Poyser.

In the original description Prof. Eaton says that the fertile and sterile fronds of *Clintonianum* differ in habit, but in the present form they apparently do not. The fern was found in a deep and shaded ravine and has maintained its form unchanged for at least three years. Recently there has been shown a disposition to consider *Clintonianum* a species distinct from *N. cristatum*. In that case the species would be *Nephrodium Clintonianum* and the form *N. Clintonianum sylvaticum*. Those who prefer *Dryopteris* will of course call the form *Dryopteris Clintoniana sylvatica*.

POLYSTICHUM ACROSTICHOIDES X ANGULARE.

By Amedee Hans.

Hybridizing plays a greater part in ferns than is generally believed and many forms that are still named species are only hybrids. This conclusion comes to one when he sees how easily some species cross when the spores are sown together. If *Camptosorus* and *Asplenium ebeneum*, though found in nature often in different localities, can produce *Asplenium ebenoides* by hybridization, there is no reason why others could not do the same, especially in the tropics where so many kinds grow together.

The different forms of *Polystichum angulare* found and raised in the British Islands, are among the finest hardy ferns on account of the finely divided fronds of some of them, but being entirely British forms, they stand the climate of our Northern States only with good protection. It occurred to me that by crossing some of them with *Polystichum acrostichoides* something could be obtained that would combine the hardiness of *acrostichoides* with the delicate cutting of some of the forms of *angulare*. Accordingly I made sowings of *Polystichum angulare venustum, P. a. divisilobatum, P. a. grandidens, P. a. perserratum* and P. *aculeatum Braunii*. No crossing resulted from the last sowing, but for the others the results were beyond expectation.

Of these sporelings, more than 1500 in number, more than 10% are distinct and all have passed the past two winters without protection and without loss, though during the first, they were only small sporelings. Different forms of *P. a. incisum* are the most conspicuous. They are of different shapes, more or less incised, undulate, recurved, crisped etc. The

others are more or less deeply cut to bipinnate and these last are easily distinguished from *P. angulare* by their glossy appearance and stronger substance. Among the rest of the sporelings, *angulare* forms are more numerous than those of *acrostichoides* but among the forms resembling the first there are many that are easily distinguished from the original plant. They are just as finely cut, but there is something different in their appearance. It would be hazardous to call them hybrids, however, until another year's trial.

Some good spores have been collected from the best of these hybrids and no doubt after a few more trials a new set of perfectly hardy plants will be obtained that will have the delicate structure of the plumose, crested and other forms of *angulare*.
Stamford, Conn.

Polystichum Acrostichoides Recurvatum.—It is a well-known fact that most of the abnormal forms of ferns found in nature reproduce themselves in a great percentage of cases from spores, the abnormality more or less accented with always some normal plants among them. An abnormal plant means a plant that has all its fronds affected in the same way; if only a few fronds are affected, it is usually accidental and cannot be reproduced by spores. Through the courtesy of our editor who sent me spores of *Polystichum acrostichoides recurvatum*, I was able to raise about one hundred sporelings of this form. They are not big enough yet to form a definite conclusion, nevertheless nearly all show signs of *recurvatum*.—*Amedee Hans, Stamford, Conn.*

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(Continued.)

SALVINIACEAE.

AZOLLA Lam.

212. **Azolla Caroliniana** Willd. AZOLLA; WATER FERN. Not common: on the surface of still water. New York, Iowa and Washington to the Gulf of Mexico; also in the tropics and southward to Patagonia.

213. **Azolla filiculoides** Lam. Not uncommon; on the surface of ditches and pools. California; also along the western slopes of the Andes.

SALVINIA Adans.

214. **Salvinia Natans** (L.) Very rare; on the surface of ponds. Perry County, Missouri. Also in the temperate parts of Europe and Asia.

MARSILIACEAE.

MARSILIA L.

215. **Marsilia quadrifolia** (L.) MARSILIA; WATER CLOVER. Very rare; in ponds and slow-moving streams. Bantam Lake, Conn., and naturalized elsewhere; also in Central Europe, and Asia to Japan and Northern India.

216. **Marsilia macropoda** Engelm. Not common; in water or in moist places. Texas and New Mexico.

217. **Marsilia uncinata** A. Br. Abundant on the banks of streams, in swamps and shallow ponds. Louisiana and Texas.

218. **Marsilia vestita** Hook and Grev. Horse Clover. Common; in moist places. Dakota, and Washington to Texas and California: also in Mexico.

219. **Marsilia vestita tenuifolia** (Engelm.) Very rare; in moist places. Texas. Only twice collected.—*M tenuifolia* Engelm.

Pilularia L.

220. **Pilularia Americana** A Br. Pillwort: Water Pepper. Rare; in moist places. Oregon, California and Arkansas; also reported from Chili.

EQUISETACEAE.

Equisetum L.

221. **Equisetum arvense** L. Field Horsetail. Very abundant: in swamps, woodlands, fields and roadsides. Throughout North America, also in the north temperate and Arctic zones of the Old World.

This is a most variable species with many named forms of no stability. The following are most important: **alpestre, arcticum, boreale, campestre, decumbens, diffusum, irriguum, nanum nemorosum, polystachyon,** and **pseudosylvaticum**. All are described in Fern Bulletin, vols. VII and VIII.

222. **Equisetum Ferrissi** Clute. Rare; in moist shades. Northeastern Illinois.

223. **Equisetum fluviatile** L. Water Horsetail. Common: in shallow ponds and ditches. Virginia, Kansas and Washington to the far

north; also in central and northern Europe and Asia—*E. limosum* L.

The form **intermedium** A. A. Eaton, resembles forms of *E. litorale*. **f. linosum** L. is a nearly unbranched form found with the type.

224. **Equisetum Funstoni** A. A. Eaton. Not uncommon; in moist places Southern California, probably in Mexico. The plants to which this name has been given were referred in older floras to *E. Mexicanum* and *E. ramosissimum*, two species not now considered members of our flora.

225. **Equisetum hiemale** L. Scouring Rush; Winter Rush. Common; in moist places. Nearly throughout North America and extending across Northern Europe and Asia.

The forms **affine, Californicum, Doelli, Drummondii, herbaceum, pumilum, Suksdorfii, ramosum** and **Texanum** are ecological forms likely to be found with the type. All are described in Fern Bulletin Vol. XI.

226. **Equisetum hiemale intermedium** A. A. Eaton. Common or abundant; in moist meadows. Mississippi Valley and westward to the Rocky Mountains. Resembles *E. laevigatum*.

227. **Equisetum hiemale robustum,** (A. Br.) Great Scouring Rush. Very common; in the Southern States. Often regarded as a mere robust form of the type. It may be noted that the correct name for this plant is *E. hiemale prealtum* (Raf.).—*Equisetum robustum A. Br.*

228. **Equisetum laevigatum** A. Br. Smooth Scouring Rush. Common; in moist meadows. New Jersey, Wisconsin and Louisiana to the Pacific coast. The ecological forms **Caespitosum, elatum, polystachyon, scabrellum, ramosum,** and **variegatoides** have been described in Fern Bulletin, Vol. XI.

229. **Equisetum litorale** Kuhl. Shore Horsetail. Rare; in moist places. New Jersey, Pennsylvania and Wisconsin northward; also in the Old World from France and Austria northward.. Variable, and often regarded as a hybrid.

The following forms have been described in Fern Bulletin, Vol. X.: **arvensiforme elatius, gracile, humile, prolifera,** and **vulgare.**

230. **Equisetum palustre** L. Marsh Horsetail. Rare; in wet grounds. New England, Illinois and Washington to the far north; also in the northern parts of Europe and Asia.

231. **Equisetum pratense** Ehr. Shade Horsetail. Rare; in cultivated fields and waste places. New Jersey, Minnesota and Colorado northward; also in the colder parts of the old world.

232. **Equisetum scirpoides** Mich. Dwarf Scouring Rush. Somewhat rare; on moist banks. Connecticut, Pennsylvania, Illinois, Nebraska and British Columbia northward to Greenland and Alaska; also in Northern Europe and Asia.

233. **Equisetum silvaticum** L. Wood Horsetail. Common; in moist shades. Virginia to Nebraska and northward to the Arctic Circle; also in the colder parts of the old world. In Vol. IX of the Fern Bulletin the following

American forms are described: **Capillare, pauciramosum praecox, pyramidale, robustum, serotinum,** and **squarrosum.** All are mere ecological phases of the plant.

234. **Equisetum telmateia** Ehrh. Ivory Horsetail. Common; in moist places. California to Alaska mostly near the coast; also from Ireland and Scotland to Siberia, Persia and North Africa.

235. **Equisetum variegatum** Schleich. Variegated Scouring Rush. Not uncommon; in moist places. From beyond the Arctic Circle southward to the northern tier of States and Illinois and Indiana; also in the old world north of the forty-second degree of latitude. The form **Alaskanum** A. A. Eaton has been reported from Alaska.

LYCOPODIACEAE.

236. **Lycopodium alopecuroides** L. Fox Tail Club-Moss. Not uncommon; in wet grounds. Long Island to Texas, mostly near the coast; also southward to Monte Video.

237. **Lycopodium alopecuroides adpressum** Chapm. Common; in sandy swamps. Massachusetts to Texas—the common form. The variety **polyclavatum** McDonald with several heads on a stem is reported from Staten Island, New York. —*Lycopodium alopecuroides Chapmani* (*Underw.*) *Lycopodium adpressum* (*Capm.*)

238. **Lycopodium alopecuroides pinnatum** Chapm. Not uncommon; in wet grounds. Georgia and

Florida to Mississippi—*Lycopodium pinnatum* (Chapm.)

239. **Lycopodium alpinum** L. Ground Fir. Common; on grassy moors. British Columbia to Alaska and Greenland; also in the Old World from Spain and Switzerland northward.

240. **Lycopodium annotinum** L. Stiff Club-Moss. Not uncommon; in moist shades. New Jersey, Minnesota, Colorado and Washington to Alaska and Greenland; also in the colder parts of the Old World.

241. **Lycopodium annotinum pungens** Spring. Somewhat rare; found with the type in the far north and on mountain tops; also in the Old World.

242. **Lycopodium Carolinianum** L. Carolina Club-Moss. Common; in sandy swamps. Central New Jersey to Florida and Louisiana near the coast; also reported from Ceylon, Hong Kong, New Guinea, Tasmania and the Cape of Good Hope.

243. **Lycopodium cernuum** L. Rare; on moist banks. Southern Mississippi, Alabama and Georgia to Florida; also around the world in the Tropics and southward to Cape Colony and New Zealand.

244. **Lycopodium clavatum** L. Ground Pine. Abundant; in woods and pastures. Mountains of North Carolina, New Jersey, Pennsylvania, Iowa and Oregon to the far north; also nearly throughout the world. Confined to the mountain tops in the tropics. A form with a single

spike to each branch is **monostachyon** Hook.

245. **Lycopodium complanatum** L. GROUND PINE; CHRISTMAS GREEN. Abundant; in woods and thickets. Georgia, Iowa and Washington to Labrador and Alaska; also nearly throughout the old world. The form **wibbei** Haberer has a single spike of fruit on each branch.

246. **Lycopodium complanatum flabelliforme** Fernald. The common form in the United States distinguished by its strongly dorsiventral leaves.

247. **Lycopodium complanatum chaemacyparissus** (A. Br.) A slenderer, more upright form found with the type and frequently regarded as a distinct species.—*Lycopodium chamaecyparissus* A. Br. *L. tristachyon* Pursh.

248. **Lycopodium lucidulum** Mich. SHINING CLUB-MOSS. Common; in moist shades. South Carolina, Alabama, Iowa and Minnesota to Labrador; also in Japan, China and the Himalayas. The form **occidentale** Clute is reported from Washington and the form **porophilum** (Lloyd and Underw.) (*Lycopodium porophilum* Lloyd and Underw.) is a dwarf form reported from Wisconsin, Indiana, Kentucky and Alabama on dry rocks.

249. **Lycopodium inundatum** L. BOG CLUB-MOSS. Not uncommon; in bogs. New Jersey, Pennsylvania, Illinois and Washington to the far north; also in Northern Europe. The form **Bigelovii** Tuckerm. is a luxuriant form that may occur with the type.

250. **Lycopodium obscurum** L. Tree Club-Moss. Common; in dryish shades. North Carolina, Tennessee and Montana to Newfoundland, and Alaska; also in Siberia and Japan.—*L. dendroideum* Michx.

251. **Lycopodium sabinaefolium** Willd. Not uncommon; in open grassy places. Northern New England and Ontario northward.

252. **Lycopodium Selago** L. Fir Club-Moss. Rare; in exposed elevated regions. North Carolina, Michigan and Washington to Alaska and Greenland; also in Northern Europe and Asia and in Australia and New Zealand.

253. **Lycopodium Sitchense** Rupr. Rare; in exposed places. Elevated regions of Maine, New York, Idaho and Washington to Labrador and Alaska.

PSILOTACEAE.

254. **Psilotum triqeutrum** Sw. Rare; on the trunks of trees. Florida; also widely spread in the tropics and reaching Japan and New Zealand.—*P. nudum* (L.)

Light and Germination of Spores.—The prothallia of most ferns are found in moist shady places and the ferns themselves are unusually adapted to a shady habitat, but notwithstanding this the spores refuse to germinate in darkness. A. C. Life who has been carrying on some experiments along this line at the Missouri Botanical Garden, writes in the 18th Annual Report that the spores of the species he used would not grow in darkness, but that germination proceded best in light of medium intensity. In very weak light the prothallia tend to take on a ribbon shape, while stronger light gave the usual heart-shaped form. Strong light seems to favor the production of archegonia and weak light produces antheridia, only. The spores of all the species experimented upon contain chlorophyll which very readily accounts for the stimulus that light gives to germination. A point which none who have investigated the germination of fern spores seem to have kept in mind is that all ferns do not have the same habitat. It may be assumed that with ferns which normally grow in the open, a higher light intensity for germination would be required than with ferns that naturally grow in the shaded ravines. A higher temperature, also, will probably be found more congenial to the spores of tropical ferns than to those of colder regions.

Development of Ophioglossum.—In ordinary ferns a new plant is produced by a fertilized egg which divides into four regions that produce the stem, leaf, root and foot respectively, but in some cases some of these organs are omitted. According to Campbell, who has been studying the Ophioglossaceae, there are

three types of embryo in this group. In one, represented by *Ophioglossum mollucanum,* the plant is an annual and develops only a root and leaf and has no stem; in another, represented by our own *O. Vulgatum,* a root and stem are produced, followed much later by a leaf; and in the third represented by the well-known *O. pendulum* of the tropics a root, only, is produced, the stem and leaf which the plant bears appearing ultimately from a bud on this root at some distance from the prothallium. It may be added that the prothallia of all these species lack the leaf-green of ordinary fern prothallia and must set up a partnership with a fungus in order to produce a new plant.

Generic Relationships.—It is a comparatively easy matter to distinguish one species from another when one is dealing only with a few specimens of each, but as the amount of material increases trouble develops, due to the variations that are absolutely certain to occur. It then becomes a very nice matter of judgement to draw the line between closely allied species, if, indeed, any hard and fast line can be drawn. Nor is this difficulty absent from the consideration of genera though from the nature of the case, it is only the student of the larger aspects of the science, working with an immense amount of material, that ever experiences any trouble. Ordinarily we have no difficulty in distinguishing an *Asplenium* from a *Nephrodium,* for instance, but if all the plants referred to these two genera were brought together, no novice could place many of the species correctly. It has long been known that *Acrostichum* and the old *Aspidium* are closely related, and in a recent publication Dr. Christ reverting to the idea, says: "The con-

tention that "Acrostichchum" is only "Aspidium" with reduced fertile pinnae appears to me to be better established than ever. Is this a step in advance in the development or a degeneration? The example of *Dryopteris canescens* where the incontestable deformation of the pinnae both fertile and sterile, is accompanied by the acrostichoid formation as to the soriferous parts, appears to me to point strongly to the latter; that is to say, an aberration and weakening of the type, which one can scarcely call only teratological, because the infiuences that have caused the changes are unknown." An excellent example of this may be seen in our common Christmas fern, whose specific name, *Acrostichoides,* was derived from the fact that it closely resembles an *Acrostichum.* While such ferns point unmistakably to an alliance of *Nephrodium* with *Acrostichum,* other forms as clearly connect it through *Phegopteris* with *Polypodium.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from, this list.

Binford, R. *The Development of the Sporangia in Lygodium,* illust. Botanical Gazette, S. 1907.

Clute, W. N.. *Naming the Ferns without a Book,* illust. American Botanist, Je. 1906.

Dobbin, F. *A Fern Community.* American Botanist, Ap 1906.

Life, H. C. *Effect of Light upon the Germination of Spores and the Gametophyte of Ferns,* illust. 18th Report of Missouri Botanical Garden, 1907.—

Under ordinary conditions fern spores of the species experimented with will not germinate in darkness. Germination was best in light of medium intensity. Weak light produces filamentous prothallia and stronger light the usual heart shaped forms.

PFEIFER, W. M. *Differentiation of Sporocarps in Azolla* illust. Botanical Gazette, D. 1907—Megasporocarps and microsporocarps develop alike for some time. The microsporocarp results from the abortion of the megaspores.

PIERCE, W. C. *Ferns,* illust. Floral Life, D. 1907—The forms of *Nephrolepis exaltata* discussed from the cultural viewpoint.

UNDERWOOD, L. M. *The Names of Some of our Native Ferns.* Torreya, O. 1907.—Calls attention to several new combinations that the publication of Christiansen's "Index" makes possible.

UNDERWOOD, L. M. *American Ferns.—VII. The American species of Stenochlaena.* Illust. Torrey Bulletin 1907.—An account of the American species which are regarded as 12 in number. Includes a description of three new species, *S. angustata* from Columbia *S. Jamaicensis* from Jamaica and *S. Maxoni* from Costa Rica. *S. Kunzeana* is reported from southern Florida.

WOODBURN, W. L. *A Remarkable case of Polyspermy in Ferns,* illust. Botanical Gazette, S. 1907.

YAMANANOUCH, S. .*Sporogenesis in Nephrodium,* illust. Botanical Gazette, Ja. 1908.—A preliminary paper to one on apogamy. The conclusion is drawn that there is a uniform number of chromosomes and in the normal life-history a reduction of chromosomes in sporogenesis.

EDITORIAL.

Some days ago, a subscriber to this magazine wrote to condole with the editor upon the demise of the FERN BULETIN. It may be needless to add that he was a comparatively new subscriber. This magazine is not dead now moribund, nor is it, to continue our pathological anology further, even in a comatose condition. The magazine is still supposed to be printed at Binghamton, but when our business was moved to Joliet and nobody left to stir up the printers, matters began to drag. Readers will recall that the January issue, though late, had to be reprinted, that the April issue was more than four months in getting through the press, and we may add for their further information, that the printers have had the copy for the next issue for nearly three months without finding time to set it up. The present number beginning a new volume is printed at Joliet with a reliable printing establishment, and no more delays of this kind need be feared. We shall continue right along with volume 16 and send the two missing numbers as soon as we can get them.

* * *

A second reason for the delay in issuing the magazine is that the editor finds himself in much the position as regards fern study that Napoleon considered himself in regard to France when he observed "The State? I am the State!" The editor is far too modest to claim that he is all there is of fern-study, but to judge from the amount of writing he is obliged to do in order to keep this magazine filled he is pretty near all of it. It is the editor's misfortune rather than his ambition that obliges him to thus appear in the role

of a monopolist. If he had the time, he feels quite sure that he could write thirty-two pages four times a year, but any reader who has a mental picture of the editor in a palatial office with nothing to do but concoct fern literature has another guess coming. A long time ago, when this magazine was started, the editor might have entertained the hope that the magazine would some day earn him a living and allow him to give his whole time to advancing the study of ferns but that was fifteen years ago. The hope he now entertains is that the magazine will continue to bring in enough revenues to pay the printer, while the editor earns his daily bread as a teacher of biology in a great city school. Business before pleasure is an old and well tried motto, and when school affairs demand attention this magazine, which is at best, a mere recreation of the editor's, must wait. The only question with each subscriber must be, is a magazine issued as irregularly as this one and containing the matter it does, worth seventy-five cents a year? Some there are that for fifteen years have given a strong affirmative to this question and have answered it for the future by paying several years in advance. Others, whether they are satisfied or not, continue to renew, as one recently expressed it, "because they have formed the habit." We are sure such good habits should not be lightly broken. We cannot, however, neglect this opportunity to express our appreciation of the indulgent attitude of our readers in regard to the delay. Those who have written about it at all, have mildly said that their two numbers were missing and if issued must have been lost in the mails.

* * *

For the year 1908 we have planned to continue our series of illustrations and notes on rare forms of ferns,

and also our illustrations of curious or interesting exotic species. These two features, alone, we feel sure will be of the greatest usefulness to fern students and worth the cost of the magazine. The check-list of North American Fernworts will be completed in this volume; additional fern-floras of the States published and various new species and forms which we have in hand will be described and illustrated. Notwithstanding this, we wish to impress it upon our readers that we are very desirous that they shall take part in the making of the magazine and earnestly invite notes and articles in our line. The department of Pteridodographica should be especially remembered when you have a note that will not do for a long article. The magazine will be issued on time if copy accumulates fast enough; otherwise it will be issued when the editor accumulates time enough.

* * *

In this issue, bills to the end of 1908 are sent out to all subscribers. They will be found facing the frontispiece. Those who have any doubts as to our ability to deliver the two missing numbers, need not pay their subscriptions until these are received. If any there be whose subscriptions expired at the end of 1907 and who do not wish to continue, they may elect to receive the first two numbers of 1908 in lieu of the missing numbers or they will be sent these numbers when printed, just as they choose. Unless notified we shall suit ourselves in the matter.

* * *

There is just as much of an evolution in fern study as there is in any other department of human endeavor. The first plant gatherer's interest in ferns

centered in their curious forms and medicinal properties. It was not until long afterward that the early botanists busied themselves with naming and studying the ferns scientifically and still later that the ferns began to be cultivated or collected for their beauty and decorative qualities. From this it was but a step to the recognition of the minute differences that characterize forms and the study of the haunts, habits, and curious traits of these magnificent plants. This sequence of interest, the first phase alone excepted, has been repeated again, and again as new countries have been discovered. To the first phase belong the books on simpling, charms and divination, to the second belong the manuals and text-books, and to the third belong the popular hand-books. In the United States and Canada we have reached the third stage, but Mexico is still in the second and many of the islands of the sea are in the first. With us, the wave of popular hand-books has pased but it is an error to think that in consequence everything interesting about ferns has been found out and published. There is still enough to be discovered to keep any who read these lines busy until all fern study for them has ceased in this world. Let no one, therefore, think he has exhausted the subject; rather let him study through his books and collections anew and prepare for the new season while yet he may.

BOOK NEWS.

The Plant World, formerly of Binghamton, and more recently of Washington, New York and Denver, has moved to Tucson, Arizona.

According to a prospectus received, Dr. Edward F. Bigelow, well known to readers of out-door literature

as the editor of the old *Observer,* will soon issue a monthly magazine of similar scope to be known as the "Guide to Nature." The publication is to be the official organ of the Agassic Association of which Dr. Bigelow was recently elected president.

At Chicago, during the Christmas holidays the American Nature Study Society was organized. All who are interested in advancing the study of nature in the schools are invited to become members. Full information may be obtained by addressing the Secretary of the Nature-Study Society, Teachers' College, New York City. Membership in the Society entitles one to the *Nature-Study Review,* the official organ of the society, now in its fourth volume.

"Walking a fine Art" is the title of an attractive little volume compiled by Edward F. Bigelow from the writings of poets and naturalists in all lands, and from original contributions by present-day walkers. Together they form a most readable book which all who love to walk in field and wood will be glad to possess. The book is published by S. E. Casino & Son, Salem, Mass.

AMERICAN FERN SOCIETY.

The annual election of the Society last November gave us the following officers for the present year: President, James H. Ferriss, Joliet, Ill.; Vice-President, Dr. D. W. Fellows, Portland, Maine; Secretary, W. A. Poyser, 6028 Delancy Street, Philadelphia, Pa.; Treasurer, Miss Nellie Mirick, 28 East Walnut St., Oneida, N. Y. At this election a larger number of votes were cast than in any previous election indicating a very gratifying interest in our work.

Standard Books on Ferns

"How Ferns Grow," by **Margaret Slosson.** With 46 plates by the author. Large 8vo. $3.00 net, by mail $3.34.

A valuable contribution to fern literature in that it not only enables fern students to distinguish different species of mature ferns, but points out characteristics of the different kinds at all stages of development, and shows the genetic relations of ferns to each other and to the rest of plant life. The plates, nearly all reproducing ferns at their natural size, are particularly excellent. Published 1906.

"No one has hitherto devoted, as the present author does, a whole book to a readable account of the youth of ferns. . . . With great pains she has studied the various metamorphoses and has recorded in good photographs her interesting results. The transformations are all well shown by the engravings, but she has supplemented these engravings by clear text."—The Nation.

"Botanical books especially, of late years, have been remarkable for wealth and beauty of illustration, but even among these "How Ferns Grow" is notable. The pictures are purely scientific, nearly all are the size of nature, and they are so numerous and so carefully arranged as to make the text almost superfluous. . . . A beautiful book that every fern lover will want."—N. Y. Sun.

"Ferns," by **Campbell E. Waters,** of John Hopkins University. 362 pp., square 8vo. Over 200 illustrations from original drawings and photographs. $3.00 net, by mail, $3.34.

A manual for the Northeastern States, thoroughly authoritative and written in a popular style. It covers all the ferns in the region embraced either in Britton's or in Gray's Manuals. A key based on the stalks, as well as one based on frutification, differentiates if from other analtical keys now existing.

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"Likely to prove the leading popular work on ferns. . . . It can confidently be asserted that no finer examples of fern photography have ever been produced."—Plant World.

"Our Native Ferns and Their Allies." With Synoptical Description of the American Pteridophta North of Mexico. By **Lucien M. Underwood,** Professor in Columbia University. Revised. xii + 156 pp. $1.00 net, by mail, $1.10.

"The elementary part is clear and well calculated to introduce beginners to the study of the plants treated of. The excellent key makes the analysis of ferns comparatively easy. The writer cordially commends the book. It should be in the hands of all who are especially interested in the vascular cryptograms of the United States."—Bulletin of the Torrey Botanical Club, N. Y.

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Joliet, Illinois

Vol. XVI No. 2

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A Quarterly Devoted to Ferns

Joliet, Ill.
Willard N. Clute & Company
1908

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THE PEDATE BRACKEN — *Doryopteris pedata.*

THE FERN BULLETIN

Vol. XVI APRIL, 1908 No. 2

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A PEDATE BRACKEN.

Doryopteris pedata.

BY WILLARD N. CLUTE.

In the tribe Pterideae to which our common brake or bracken (*Pteris aquilina*) belongs, there are at least a dozen genera, among which may be mentioned as typical *Pellaea, Chilanthes* and *Lonchitis.* The characteristic recognition marks of the tribe are found in the sori which are placed at the ends of the veins near the margin of the frond, or upon a vein-like receptacle connecting the tips of the veins, and covered with some sort of an indusium formed by the reflexed margin of the frond. With genera as with species, however, it is easy enough to recognize typical and well-marked examples; the trouble arises in trying to draw the line between those which shade off into other groups with characters that make them as well placed in one as in the other. In consequence of this, the limits of the tribe are, in a measure, matters of opinion and botanists are not entirely agreed as to just what genera should be included in it. In the same way, the genus *Pteris* for which the tribe is named, consists of a hundred or more species differing so greatly among themselves that the different groups into which they naturally separate are often considered to be distinct genera as is often the case with similar groups in *Polypodium* and *Nephrodium.*

JUN 7 1908

It thus happens that the subject of this sketch sometimes finds itself in the genus *Pteris* and again in the

genus *Dorypteris*. Linnaeus knew the plant as *Pteris pedata* but John Smith, a former curator of the Royal Botanical Gardens at Kew, concluded that the reticulated venation of this species, so unlike that of the true brackens, entitled it to be placed in a distinct genus and therefore called it *Doryopteris pedata*.

If generic relationships depended alone upon the superficial appearance of plants, our species would still have much to warrant its being placed in a separate genus, for its fronds, not unlike certain geranium leaves in appearance, have little of the conventional fern frond about them. It is to be noted, however, that even these fronds have a hint of the triangular in them such as many species in the genus *Pteris* exhibit and which is well shown in the common brake. But it is the venation and arrangement of the sori that must furnish the decisive features, and in these it differs so much from the true brackens that it seems well placed as *Doryopteris*. In the present instance the great value of veining and disposition of the sori in determining genera is shown by another species *Pellaea geraniifolia* that at first glance is almost exactly like our plant. This, too, was once considered a member of the *Pteris* genus, but is now regarded as a *Pellaea* because the sori are on the tips of free veins not connected by a transverse vein. Its veins being free and not reticulated very clearly distinguishes it from *Doryopteris*.

The pedate bracken is found from the West Indies to Southern Brazil, being not uncommon in half shaded situations. Its fronds spring in tufts from a short rootstock and are a foot or more in length, with rather thick blades and dark and polished stipes and rachises. The spore-cases are usually abundant

and at maturity form a heavy brown margin to the pinnae.

The specimen figured as our frontispiece is from the ferns of Southern Brazil named by Dr. Rosenstock. Certain small differences in the stipe and blade led him to describe it as a new species, *Doryopteris stierii*, in *Hedwigia*, but he has later regarded it as a variety. In the same journal two additional forms of this species are described.

REDISCOVERY OF CHEILANTHES PARISHII.

BY C. F. SAUNDERS.

On a visit to Palm Springs, in the Colorado Desert, Southeastern California, in March of the present year, I had the good fortune to collect a single plant of *Cheilanthes Parishii*—one of the rarest of North American ferns. It was originally discovered by Mr. S. B. Parish (for whom it was named) in the same locality 27 years ago and has never been reported since. My specimen grew in a crevice of rock on the side of Andreas Canon, where the first collection was made, and though I searched carefully for more plants of it, could find none.

Pasadena, California.

[To Mr. Saunders' interesting and valuable note, we take the liberty of adding the following observations by Mr. S. B. Parish, originally published in Vol. IX, No. 4, of *The Fern Bulletin*.—Ed.]

It is now some twenty years since the type specimens of these two species [*Cheilanthes fibrillosa* and *C. Parishii*] were gathered; their validity has not been doubted by any subsequent student of ferns, but they remain known only from the original collections. To

facilitate their rediscovery it appears desirable to place on record the exact places at which the types were found. Both were discovered at the base of San Jacinto Mountain but on opposite sides of it, in what was formerly San Diego, but is now Riverside county. *Cheilanthes Parishii* came from the eastern or desert base of that mountain. Here, under its shelter an arm of the desert pushes in and is watered by three streams which drain its acclivities. A hot sulphur spring rises in the plain which gave the place its Spanish name of Agua Caliente. Twenty years ago it was occupied only by Indians who soaked away their physical ills in the hot pool and supplied their primitive wants from the fruits of their gardens aided by the fruits of the palm, the mesquite and other native vegetation. Perhaps it is best barely to refer to the snakes, caterpillars and other animal food which gave relish to this vegetarian diet. But this is all changed, now, even the name. A little hamlet called Palmdale—or sometimes Palm Springs—clusters around the sulphur spring, the few Indians who remain are crowded to the outskirts and the valley is occupied by vineyards and apricot orchards which ripen their fruit long before any other in Southern California. The inhabitants are almost exclusively sufferers from lung troubles who find life in this warm and dry atmosphere. The altitude is but 500 feet above sea level and the climate is charming in winter but in summer the place in an oven. The natural vegetation is abundant a botanist could not spend a fortnight of his winter vacation in California amidst a more novel and interesting flora.

Some three miles up the valley from the springs a cluster of a few houses and orchards bear the enticing

name of "The Garden of Eden." Opposite comes down a canyon from which the garden is watered. An Indian named Andreas used to live at its mouth and from him it was named Andreas' canyon. Up it ran a difficult trail leading to nowhere. Perhaps three miles, or it may be more or less, for the distance is a guess at this length of time, this trail crossed over a low ridge of the mountain to avoid the narrow gorge through which the stream at that point flows and just above, it came to an end under a cliff on the left bank. Here we sat down by the cool stream and ate our lunch and then turning to an examination of the cliff, collected among other things the type of the fern of which I am writing. This was in March, 1881 and I was just beginning my acquaintance with the desert flora. Almost every plant was unknown to me so that my overloaded press could contain but a scanty gathering of any one species. I saw that the fern was new to me but had no thought that it would prove to be so to better informed students and so made no exception in its favor. The few specimens gathered were sent to Mr. Davenport who described and figured them in the *Bulletin of the Torrey Botanical Club*, 8:61. In April of the next year I revisited the place confidently expecting to secure a good supply of the new fern but without succeeding in finding a single specimen. I have never been there since, nor, I am confident, has any other botanist. I hope others may not be deterred by my disappointment and may be more fortunate. As as aid to such an one, I will remind him that the fern has a considerable general resemblance to *Notholaena Parryi*, which is very abundant in that region, but it is readily distinguished on close examination.

NEW STATION FOR A RARE FLORIDA FERN.

BY WILLARD N. CLUTE.

Until recently the claim of *Hypolepis repens* to a place in the fern flora of the United States rested upon a single specimen from Oakland, Florida, reported some years since by L. M. Underwood. Many parts of this state are still so little known, botanically, that further reports of the occurrence of this fern, instead of occasioning surprise are rather in the line of the expected.

The good fortune of discovering a second locality for this species belongs to Rev. and Mrs. J. C. Armstrong of Chicago, who first found it a year or more ago while wintering in Florida. The new locality is near Lake Charm, in Orange County, Florida, about 18 miles north-east of Sanford. Mrs. Armstrong writes me that the colony consists of at least a hundred plants growing thriftily in the rich black soil and deep shade of hammock land in company with *Blechnum serrulatum*. Some of the fronds were more than three feet high.

The typical *Hypolepis repens* has a prickly stipe and rachis but the Armstrong plants, though somewhat rough are not at all prickly and apparently belong to Hookers variety *inermis* which differs very little from the type in other respects.

At first glance the plant has the appearance of a *Dicksonia* since it bears its sporangia on a reflexed tooth of the pinnule, but a closer look shows instead of the inferior, bowl-shaped indusium of *Dicksonia*, the sori gathered at the tips of the veins and covered by an indusium formed by the reflexed margin of the lesser divisions of the frond. Its affinities will thus be seen to be with *Pteris*, *Pellaea* and *Chilanthes* and not so very far removed from *Adiantum*. Plants sent to the north a year ago have taken kindly to pot culture and are reported as excellent for this purpose.

SOLAR PRINTS OF PLANTS.

BY JAMES SHEPARD, NEW BRITAIN, CONN.

It is nothing new to make solar prints direct from plants, but the result is unsatisfactory as it gives a white image on a dark ground. This produces a negative from a positive and is not pleasing because it is the reverse of nature. But if we go one step further and use the direct print as a negative to make other prints from, the result will be a print in harmony with nature and an exact print of the plant itself. The most simple and convenient of all solar printing papers is the ordinary blue print paper. This however cannot be used for making a negative, as a blue ground will not cut off the rays of light sufficiently to give any substantial contrast in a print made from such a negative.

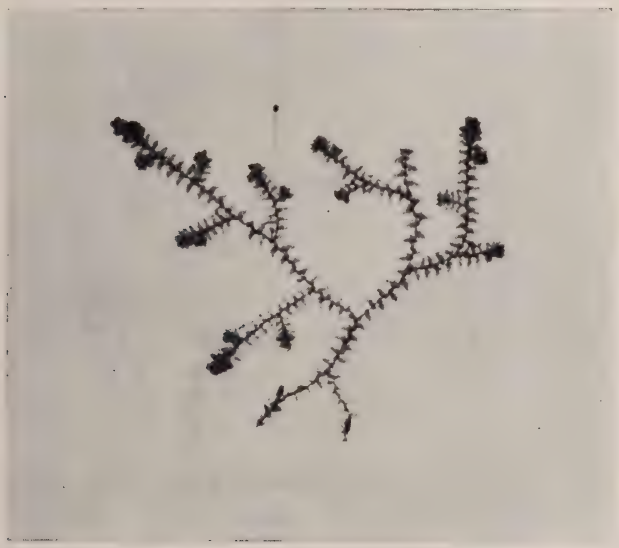
The best cheap negative paper is that known as "Vandyke Solar Paper." I have used this paper for many years obtaining the same from Messrs. Eugene Dietzgen Co., 124 W. 23rd, St., New York City. It is sold in rolls of ten yards in three different widths, of either thick or thin paper. A ten yard roll, thirty-six inches wide, costs only $2.10 and the roll may be cut into as many lengths as desired without extra cost. I use the thin paper in rolls 36 inches wide cut into four lengths each 9 inches wide. It is easy to cut from the end of a nine inch roll any size desired, not exceeding nine inches in its lesser dimensions. Fixing salts to be disolved in water for a fixing solution come with the paper. This paper gives white transparent lines on an *opaque* dark brown background. It is as simple to use as the ordinary blue print paper, is permanent, and unlike the blue print paper will keep indefinitely without imparing its printing qualities, so that old paper is as good as new.

To make negative of plant, or any portion thereof, place it on the glass of an ordinary printing frame and then place the Vandyke paper on the top of the

plant and the glass with the face side of the paper towards the glass. Then put in and fasten the back of the printing frame to secure the plant and paper in close contact with each other. Care should be taken to properly arrange the plant in the frame after which place the frame where the sun will shine directly upon the glass. As soon as the ground of the paper darkens to a deep yellowish brown remove the paper and place it face side up under a stream of running water for five

minutes to wash it. Then pour a little of the fixing solution on the paper wetting all parts thoroughly, then wash the print again and hang it up to dry. The brown of the wet negative turns darker in drying. From three to five minutes exposure in bright sunshine is ample, but this can be varied somewhat according to the nature of the plant. If the plant is thick and opaque a longer exposure is desirable, but if the plant is quite thin and translucent, care must be taken not to over print it. Fig. 1 illustrates a negative printed

direct from a spray of *Selaginella* and Fig. 2 illustrates the second printing operation, that is, a print from the negative Fig. 1, instead of a direct print from the plant. The original print thus produced in Fig. 2 was a white and brown-black print on ordinary solio paper. The negative can be used repeatedly for making any number of prints on any kind of solar printing paper. The ordinary blue print paper and the Vandyke paper are the more simple and convenient to use, as no baths for



toning etc. are required. The blue printing paper has an advantage over the brown printing Vandyke paper for the final print, in that a little tinge of blue in the high lights makes them look clearer, whereas a little tinge of brown in the high lights makes them look dingy. A plant with thin leaves may be exposed long enough in making the negative to print through the leaves and show the veins a little instead of producing a mere silhouette. Observe that this result is shown by the half tone lights in Fig. 2. The Vandyke paper

can be used for making a solar negative direct from writing, printing, or drawing, as well as from a plant, so that the image of anything in black or brown that is on one side only of translucent paper, can be reproduced correctly in the form of a positive from a positive without the use of a camera

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ON SOME NEW ZEALAND FERNS.

BY WILLARD N. CLUTE.

Through the kindness of Mr. George E. Smith, Esq., of Aratapu, New Zealand, the only representative of the American Fern Society in that far-away land I received, recently, a parcel of New Zealand ferns with the request that I keep a set for myself and give the rest to fellow members of the Society. In accordance with these directions, I have presented sets of the ferns to the President and Secretary of the Society and the remainder will be sent to members for the cost of postage as noted at the end of this article.

As collections of this kind have considerable interest for comparison with our own ferns, a list of all the species sent is here given with various notes.

1. *Lomaria Vulcanica.* On hillsides and banks of streams, Kakahi, N. Z. The sterile frond of this species has considerable resemblance to those of *Blechnum occidentale* to which the *Lomarias* in general are nearly related.

2. *Lomaria Pattersoni.* This species forms large clumps on the surface of the earth in dense forest. Kakahi, N. Z. The fertile frond of this is pinnate while the sterile is deeply cut into a few broad, acuminate pinnules. According to "Synopsis Filicum" the true *Pattersoni* was supposed to always be simple fronded, while a second species named *L. elongata* was always pinnate. They have, however been found to completely intergrade.

3. *Lomaria fluviatilis.* On the edge of bush clearings at Owhango, N. Z. This species is readily separated from its allies by the shape of its pinnae, those of the sterile frond being orbicular, while those of the fertile frond are narrow and pod like. At first glance it suggests *Notholaena trichomanoides* of our own Tropics, but it lacks the colored farina on the under surface.

4. *Lomaria alpina.* In open country on the banks of streams. This is a pretty little species closely related to *Lomaria spicant* whose place it takes in the Southern Hemisphere. Like *L. spicant* the fertile fronds are erect and the sterile more or less spreading.

5. *Polystichum aculeatum.* Banks of the Wanganni River, N. Z. Mr. Smith reports that the caudex of this species attains the thickness of a man's thigh and that the fern is fond of growing on the edge of bush clearings. The fern is unmistakably our well known plant and is found in one form or another in nearly every part of the world.

6. *Davallia Novae Zelandiae.* On the banks of streams and in dense bush, Kahahi, N. Z. A very finely cut and feathery species reminding one of certain decompound *Asplcniums.*

7. *Polypodium australe.* On trunks of trees in dense forest Owhango, N. Z. A small species with entire linear fronds which might be mistaken for an *Asplenium* by reason of the elongated sori. Many botanists place this and several others with similar sori in a separate genus *Grammitis* on acount of the elongated fruit-dots. Our plant encircles the earth in the far south.

8. *Polypodium grammitidis.* On trunks of trees in dense forest, Makatoti, N. Z. A handsome species

with narrow segments closely allied to *P. cultratum* of the West Indies.

9. *Lindsaya trichomanoides.* The *Lindsayas* are the nearest relative of the maidenhair ferns (*Adiantum*) and the pinnules have much the same general shape in many species. The indusium is formed, as in *Adiantum* by a reflexed portion of the pinnule, but there is a second indusium springing from the surface of the frond, which *Adiatum* does not have.

10. *Dicksonia antarctica?* The customs officials were not particularly careful of the labels in the packet and this one was lost. The frond appears to be from the species mentioned which is not uncommon in New Zealand.

11. *Hymenophyllum flabellatum.* On the trunks of trees ferns in dense shade, Kakahi, N. Z.

12. *Hymenophyllum Javanicum.* In marshy places and on the banks of streams in dense shade, Kakahi, N. Z. This was sent for the widely distributed *H. polyanthos* but unlike the latter species has winged stipes.

13. *Hymenophyllum scabrum.* On trunks of trees and rocks in low lying places in dense shade, Kakahi, N. Z. This species seems confined to New Zealand.

14. *Hymenophyllum pulcherrimum.* On trunks of trees in dense forests, Raurium, N. Z. Has a general resemblance to *H. flabellatum* but easily distinguished from it.

15. *Hymenophyllum Franklinianum.* In dense forest on the trunks of trees, Owhango, N. Z. A delicate species related to *H. sericeum* of tropical America. It is so heavily clothed with tawny hairs as to quite obscure the green of the frond. This is frequently named *H. Aeruginosum.*

16. *Trichomanes reniforme.* On trunks of trees in dense forests, Kakahi, N. Z. A curious round-

leaved fern with the margin thickly set with the curious funnel shaped involucres. The fronds of most of the "filmy ferns" are but one cell thick. The present species is much thicker, one of the thickest of the genus, in fact.

17. *Todea superba.* Forming large clumps in dense shade. Found only at the southern end of Island at an altitude of 2,000 feet. This handsome specimen is remarkable for belonging to the only other genus in the Osmundaceae. In *Osmunda* the sporangia are borne in much transformed fronds or parts of fronds, but in the *Todeas* the spore-cases though like those of *Osmunda* are on the backs of ordinary fronds and the ferns might easily be mistaken for members of the Polypodiaceae. The whole genus is confined to Australia and New Zealand with the exception of one species that extends to South Africa.

18. *Gleichenia Cunninghami.* On banks of streams, Owhango, N. Z. Confined to New Zealand.

19. *Gleichenia dicarpa.* On open pumice flats and marshy places, Owhango, N. Z. A diminutive species with very narrow pinnae and forking branches. Received under the name *G. alpina* by which name the plant is frequently called.

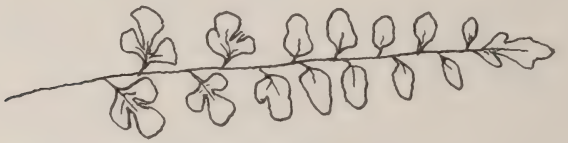
20. *Lycopodium vulcanicum.* The label of this species was lost in transit. It is much like our common *Lycopodium obscurum* in appearance,being the counterpart of that species in the Southern Hemisphere.

There still remain a few specimens each of Nos. 1, 7, 8, 11, 15 and 16. These will be sent to the first member of the Society who apply enclosing three cents in stamps for postage. A full set cannot be promised to any member, but one or more specimens can probably be sent. Applications should be made at once.

Joliet, Ill.

RARE FORMS OF FERNS—VII.

Although the opportunities for hybridizing among ferns are much rarer than they are among flowering plants, hybrid ferns undoubtedly occur. In a few cases, such as that of *Camptosorus rhizophyllus X Asplenium ebeneum* (*Asplenium ebenoides*) the hybrid nature of the plant has been proved experimentally but in most, the hybridity has been inferred from the resemblance of the new form to its supposed



ASPLENIUM TRICHOMANES X RUTA-MURARIA.

parents. The latter seems to be the case with the specimen here illustrated, the dark stipe and lower rachis and the shape of the upper pinnae being taken to indicate *trichomanes* characters while the distant, three-parted lower pinnae, the green upper rachis and the long stipes are held to be characteristic of *ruta-muraria*.

Until about three years ago, this plant was not known to be a member of our fern flora. In 1905 Mr. G. A. Woolson found it near Proctor, Vt., growing within three feet of *Asplenium ruta-muraria* and not very far removed from *A. Trichomanes*. The plant had previously been known from Europe and was given the name it bears by Ascherson and Graebner in 1896. Dr. Christ figured it in "Die Farnkrauter der Schweiz," but since hybrids are likely to vary considerably it is desirable that an illustration of the American form be

given. The figure here shown was drawn from a blue print of one of the fronds collected by Mr. Woolson which was made by Mr. Geo. E. Davenport at the time the discovery was announced. It is quite likely that the plant will be found in other regions where both the parents species occur, and other collectors should be on the watch for it.—*W. N. C.*

"OSTRICH FERN VAR. PUBESCENS."

It was certainly through inadvertence that the editor made the above unfortunate mongrel combination in the January *Bulletin.* It is well known, if iteration can make a thing well known, that he does not care for the honor of new combinations; but he must bear in mind the fact that all new names must be kept track of, and a cataloger is caused no end of trouble by such looseness. What is the editor's name for the ostrich fern? If it had but one it would be a simple matter to decide. Unfortunately it has had nine, as follows:

Osmunda Struthiopteris L. (1753).
Struthiopteris filicastrum All. (1785).
Onoclea struthiopteris Hoffm. (1795).
Onoclea nodosum Schkuhr (1809).
Struthiopteris Germanica Willd. (1809).
S. Pensylvanica Willd. (1810).
S. europea Hornem. (1813).
Matteuccia Struthiopteris Todaro (1866).
Pterinodes Struthiopteris Kuntze (1891).

Adherents to the Vienna Code would call this *Struthiopteris Germanica* var. *pubescens;* but as the generic name was first used for *Blechnum,* then for *Osmunda,* and finally for this plant, adherents to the principle that if a name is once a synonym it is always

a synonym would call it a variety of *Matteuccia Struthiopteris*. What the name will be under Mr. Clute's code can only be conjectured till he enlightens us.—*A. A. Eaton, Ames Botanical Laboratory, N. Easton Mass.*.

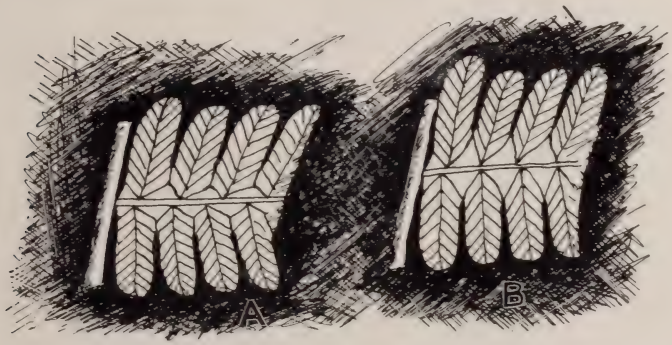
[It never occurred to the author of the name that has given Mr. Eaton so much trouble that a mere pubescent form of the ostrich fern was of enough significance to merit an extended description in Latin and the citation of synonomy from the dawn of creation to the present. Mr. Terry did not think it important enough for a name, and the editor merely suggested that it be called the form *pubescens* in order to have a handle for it. He will continue to use this name writing the name of Mr. Terry, and not his own, after it as sponsor. We note, however, that a prominent New England botanist has recently made a new species of fern that differs from one previously known only in *the form of pubescence;* so it is possible that one cannot be too careful in making species now that nomenclature has got down to parting hairs if not splitting them. We would therefore first describe the fern as *Struthiopteris pubescens* with all the hard things Mr. Eaton has said about it in synonmy added. Then we should label it again *S. Germanica* forma *pubescens,* and yet again as *S. Pennsylvanica f. pubescens.* Next paying our respects to the memory of Todaro we would call it *Matteuccia pubescens,* also *M. Struthiopteris* f. *pubescens* and still also *M. Struthiopteris* var. *pubescens,* in this separate citation of form and variety following the illustrious example set in a recent Boston publication. Of course all this makes trouble for the cataloguer, but what is a cataloguer for? Serves him right for wasting time on the names of plants when

he might be studying the plants themselves. But now, in all seriousness, to answer Mr. Eaton's question as to our name for this fern under discussion we would say we would prefer to call it *Struthiopteris Germanica* f. *pubescens* Terry.—*Ed.*]

NEPHRODIUM PATENS AND NEPHRODIUM MOLLE.

By Willard N. Clute.

There has always been some question as to the range of *Nephrodium molle* in the United States, owing to its close resemblance to *N. patens*. Many good collectors contend that it does not belong naturally to our



A—*N. Molle.* B—*N. Patens.*

PINNAE OF NEPHRODIUM.

flora and if found at all is merely an escape. The corectness of this contention can not be questioned until the collector in the field can recognize the two species at sight and give us more abundant data than we have at present. While the two are superficially very much alike, especially in the herbarium, the re-

semblances are only superficial and a few minutes given to learning their differences will make any collector able to recognize either species at a glance.

In the field *N. patens* is absolutely distinguished from the plants that resemble it by its creeping rootstock with the fronds arranged along it in two rows. *N. molle* has an erect rootstock and the fronds in a crown. In the herbarium, where often one has no rootstock to aid in the identification, dependence must be placed upon the venation. In *N. patens* the veins are simple and the lowest pair meet at, or just below, the sinus. In *N. molle* the lowest pair of veins meet at some distance from the sinus, forming narrow areolae and sending a single vein to the sinus. The two types are well shown in our illustration.

There has recently been reported from Florida a third species belonging to this group named *N. stipulare* This differs from *N. molle* in having the lowest pair of veins free or running *together* to the sinus and from *N. patens* by its more or less erect rootstock. This latter characteristic does not seem to be constant for there is one variety named *pseudopatens* indicating how closely the two are connected. A variant form of *N. patens* can thus be more easily mistaken for *N. molle* and all reported occurrences of *N. stipulare* should be investigated with more than usual care.

Fern students are in need of a careful mapping of the range of *N. patens* and *N. molle* and we suggest that all who have collected either of these species, reexamine them and send us any new data thus obtained.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(Continued.)

SELAGINELLACEAE.

SELAGINELLA, Beauv.

255. **Selaginella apus** (L.) CREEPING SELAGINELLA. Not uncommon; on moist banks and in wet meadows. Maine and Ontario to Florida, Texas and British Columbia. Represented in the Tropics by many closely allied species.

256. **Selaginella arenicola** Underw. SAND BARREN SELAGINELLA. Not uncommon; in sandy soil. Florida to Louisiana and Texas.—*Selaginella arenaria* Underw.

257. **Selaginella Bigelovii** Underw. Tolerably common; in exposed places and the chinks of rocks. Southern California.

258. **Selaginella cinerascens** A. A. Eaton. Somewhat rare; on dry bare hills. Southern California.—*Selaginella bryoides* Nutt.

259. **Selaginella Douglasii** (H. and G.) Rare; in damp shades. Northern California to British Columbia and Idaho.

260. **Selaginella lepidophylla** Spring. RESURRECTION MOSS. Common; in dry and open places. Texas, Arizona, and New Mexico; also southward to Peru.

261. **Selaginella Ludoviciana** A. Br. Rare; in moist shades. Florida, Alabama and Louisiana.

262. **Selaginella Oregana** D. C. Eaton. OREGON SELAGINELLA. Not uncommon; in dense shade,

on soil or the branches of trees. Oregon and Washington near the coast.—*Selaginella struthioloides* (Presl.)

263. **Selaginella Parishii** Underwood. Rare. Southern California.

264. **Selaginella Pringlei** Baker. Very rare; Chenate Mountains, Texas, also in Mexico.

265. **Selaginella rhodospora** Baker. Rare. Southern Florida; also in Eastern Cuba.

266. **Selaginella rupestris** (L.) Rock Selaginella. Not uncommon, especially on granite rocks. New England and Ontario to Alabama, California and British Columbia. Reported also from South America, India and Ceylon. Many forms have been described as species. A key to these will be found in *Fern Bulletin,* Vol. X. Many of these are separated by minute distinctions and may be disposed of as follows:

The form **Bolanderi** (Hieron) is from California.—*S. Bolanderi* Hieron; f. **Bourgeaui** (Hieron.) is from Oregon.—*S. Bourgeaui* Hieron.; f. **Engelmanni** (Hieron.) is from Colorado.—*S. Engelmanni* Hieron.; f. **Hanseni** (Hieron.) is from California.—*S. Hanseni* Hieron.; f. **Haydeni** (Hieron.) is from Oregon and Nebraska.—*S. Haydeni* Hieron.; f. **Montaniensis** (Hieron.) is from Montana.—*S. Montaniensis* Hieron.; f. **Schmidtii** (Hieron.) is from Alaska.—*S. Schmidtii* Hieron.; f. **Wallacei** (Hieron.) is from Orogon.—*S. Wallacei* Hieron.; f. **Wrightii** (Hieron.) is from New Mexico.—*S. Wrightii* Hieron.

267. **Selaginella rupestris acanthanota** (Underw.) Rare; Costal plain of the Carolinas and Georgia. This and the five following are forms of *S. rupestris* that are somewhat more distinct than other forms.—*Selaginella acanthanota* Underw.

268. **Selaginella rupestris densa** (Rydb.) Rare. Western Nebraska and Montana.—*Selaginella densa* Rydberg.

269. **Selaginella rupestris Fendleri** (Underw.) Not uncommon. Colorado and New Mexico.—*Selaginella Underwoodii* Hieronymus.

270. **Selaginella rupestris rupincola** (Underw.) Rare. New Mexico and Arizona.—*Selaginella rupincola* Underw.

271. **Selaginella rupestris Sherwoodii** (Underw.) Not uncommon; North Carolina.—*Selaginella Sherwoodii* Underw.

272. **Selaginella rupestris tortipila** (A. Br.) Rare. Mountains of the Carolinas.—*S. tortipila* A. Br.

273. **Selaginella spinosa** Beauv. Mountain Moss. Rare, or common northward; in moist places. Elevated parts of Maine, New Hampshire, New York, Michigan and Colorado, northward; also in Greenland, the British Isles and Northern Europe.—*Selaginella selaginoides* (L.)

274. **Selaginella Watsoni** Underw. Rare. Mountains of Utah, Nevada and California.

275. **Selaginella Watsoni mutica** (D. C. Eaton.) Rare. Mountains of Colorado, Arizona and New Mexico.—*Selaginella mutica.* D. C. Eaton.

ISOETACEAE.

Isoetes L.

276. **Isoetes Bolanderi** Engelm. Not uncommon; in mountain lakes. Colorado, Utah and California.

The form **pygmaea** (Engelm.) is a small form collected but once.—*Isoetes pygmaea* Engelm. Form **Sonnei** is reported from Donner Lake, California.

277. **Isoetes Butleri** Engelm. Rare; in wet weather lakes. Prairies of Tennessee, Missouri and Oklahoma. The form **immaculata** occurs with the type.

278. **Isoetes Canadensis** (Engelm.) Rare; in rivers and streams. Maine to Ontario and Pennsylvania; also in British Columbia.—*Isoetes Dodgei* A. A. Eaton.

The form **Robinsii** A. A. Eaton is reported from Massachusetts and the form **Amesii** (A. A. Eaton) apparently belongs here.—*Isoetes saccharata Amesii* A. A. Eaton.

279. **Isoetes Echinospora Braunii** (Dur.) Common; in lakes and ponds. Pennsylvania, Utah and Washington to Alaska and Greenland. The typical species is also found in Europe.—*Isoetes Echinospora Brittoni* Cockerell.

The following forms have been reported

from America f. **Boottii** (A. Br.) is from Massachusetts.—*Isoetes Boottii* A. Br.; f. **Flettii** (A. A. Eaton) is from Washington and British Columbia.—*Isoetes Flettii* A. A. Eaton; f. **maritima** (Underw.) is from Vancouver Island.—*Isoetes Maritima* Underw.; f. **muricata** (Dur.) ranges from Nova Scotia to New Jersey.—*Isoetes muricata* Dur.; f. **robusta** Engelm. is from New Hampshire and Vermont.

280. **Isoetes Engelmanni** A. Br. Common; in shallow water or on moist banks of streams. Maine to Delaware and Missouri.

The forms **Caroliniana** A. A. Eaton from Carolina, f. **fontana** A. A. Eaton from Pennsylvania and f. **Georgiana** Engelm. from Georgia have been reported; f. **graci is** Engelm. is found with the type.

281. **Isoetes flaccida** Shuttlew. Not uncommon; in ponds and streams, Florida.

The forms **Chapmani** Engelm. and **rigida** Engelm. have been reported with the type.

282. **Isoetes foveolata** A. A. Eaton. Rare. New Hampshire and Massachusetts. The form **plenospora** A. A. Eaton is reported with the type.

283. **Isoetes Gravesii** A. A. Eaton. Rare. Connecticut.—*Isoetes valida Gravesii* (A. A. Eaton.) *Isoetes Eatoni Gravesii* (A. A. Eaton.)

284. **Isoetes hieroglyphica** A. A. Eaton. Rare; in lakes. Maine. Possibly a form of *Isoetes Tuckermani*.

285. **Isoetes Howellii** Engelm. Not uncommon. California to Idaho and Washington.—*Isoetes nuda* Engelm.; *Isoetes Underwoodii* Henders.

The form **Piperi** (A. A. Eaton) is reported with the type.—*Isoetes Piperi* A. A. Eaton.

286. **Isoetes Macounii** A. A. Eaton. Very rare. Atka Island off the coast of Alaska.

287. **Isoetes macrospora** Dur. Somewhat rare. New Jersey, Lake Superior, Colorado and California northward. The closely allied *Isoetes lacustris* is common in Northern Europe.

The form **heterospora** (A. **A.** Eaton).—*I. heterospora* A. A. Eaton is reported from Maine; f. **paupercula** Engelm. is reported from Colorado and California.—*Isoetes occidentalis* Henders.

288. **Isoetes melanopoda,** J. Gay. Common; in wet weather lakes. Illinois, Iowa and Nebraska to Texas and California. The form **pallida** Engelm. is reported from Texas and f. **Californica** A. A. Eaton, from California.

289. **Isoetes melanospora** Engelm. Very rare. Stone Mountain and vicinity, Georgia.

290. **Isoetes minima** A. A. Eaton. Very rare. Damp prairie near Waverly, Washington. Collected but once.

291. **Isoetes Nuttallii** A. Br. Rare; on the banks of rivers and streams. California to British Columbia and Idaho.

292. **Isoetes Orcutti** A. A. Eaton. Rare; in wet weather pools. San Diego, California; also in Lower California.

293. **Isoetes riparia** Engelm. Rare. Along the Delaware River. It is probable that this and the following are two forms of the same species in which case the following might be named *Isoetes riparia saccharta* (Engelm.)

294. **Isoetes saccharata** Engelm. Not uncommon; on tidal flats about Chesapeake Bay and in the rivers that empty into it.

The forms **Palmeri** A. A. Eaton and **reticulata** A. A. Eaton are seasonal forms found with the type.

295. **Isoetes Tuckermani** A. Br. Not uncommon; in rather deep water. New England.

The forms **borealis** A. A. Eaton and **Harveyi** (A. A. Eaton) are reported from the northern parts of the species' range.

296. **Isoetes truncata** (A. A. Eaton.) Not common; Vancouver Island to Alaska.—*Isoetes echinospora truncata* A. A. Eaton

297. **Isoetes valida** (Engelm.) Rare. New Hampshire to Delaware and Virginia.—*Isoetes* Eatoni Dodge; *Isoetes Engelmanni valida* Engelm.

Death of Mrs. Horton.—We note with deep regret the death of Mrs. Frances B. Horton at Brattleboro, Vt., Aug. 18, 1907. Mrs. Horton was the discoverer of a cut-leaved form of *Asplenium ebeneum* in Vermont which Mr. Davenport named *Hortonae* in her honor.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from, this list.

BENEDICT, R. C. *Studies in the Ophioglossaceae.—I.* Torreya, Ap., 1908.—Notes on terminology and a key to the American species of *Ophioglossum.*

CLUTE, W. N. *A check-list of the North-American Fern-worts.* Fern Bulletin Ja. 1908.—A continuation embodying the Salviniaceae, Marsiliaceae, Equisetaceae and Lycopodiaceae.

CLUTE, W. N. *A New Fern.* Illust. American Botanist F. 1908.

CLUTE, W. N. *A New Fern from the United States.* Illust. Fern Bulletin, Ja. 1908.—Description of *Asplenium Ferrissi.*

CLUTE, W. N. *But Half a Fern.* Illust. Fern Bulletin, Ja. 1908.—An account of the structure and functions of the gametophyte.

CLUTE, W. N. *Generic Relationships.* Fern Bulletin, Ja. 1908.

CLUTE, W. N. *Rare Forms of Ferns.—VI.* Illust. Fern Bulletin, Ja. 1908.—Description of *Nephrodium cristatum clintonianum silvaticum.*

CLUTE, W. N. *The Genus Acrostichum.* Illust. American Botanist Ja. 1908.

EATON, A. A. *Normenclatorial Changes in Isoetes.* Rhodora, Mr. 1908.—*Isoetes Macrospora hetrospora* and *I. Dodgei Robinsii* made as new combinations.

FOSTER, A. S. *Polypodium Scouleri.* Muhlenbergia, Ap. 1908.—Several stations for this fern in Washington and Oregon reported.

HANS, A. *Polystichum acrostichoides X Angulare.* Fern Bulletin, Ja. 1908.—An account of hybridizing the species mentioned.

HANS, A. *Polystichum acrostichoides recurvatum.* Fern Bulletin Ja. 1908.

KAUFMAN, P. *Rue Spleenwort and Cliff Brake.* American Botanist, F. 1908.

MAXON, W. R. *Studies of Tropical American Ferns No. 1,* illust. Contributions from the U. S. National Herbarium, Mr. 30, 1908.—Description of various new species mostly from tropical America.

ROBINSON, C. B. *Botrychiums in Sand.* Torreya, N. 1907.—*B. lanceolatum, B. matricariaefolium* and a form of *B. ternatum* on sand dunes near the Gulf of St. Lawrence.

TERRY, W. A. *A New Variety of the Ostrich Fern.* Fern Bulletin, Ja. 1908.—The variety *pubescens* described.

YAMANOUCHI, S. *Spermatogenesis, oogenesis and fertilization in Nephrodium.* Illust. Botanical Gazette Mr. 1908.—Reports the number of chromosomes in the gametophyte to be constant (64 in number).

EDITORIAL.

During the past few months, an unusual number of letters containing money addressed to us, have failed to arrive and the fact that so many letters have gone astray in so short an interval appears to us to be something more than a co-incidence. We suggest to our subscribers, therefore, that in sending us money, it should be sent in a form that can be easily traced. Money-orders, registered letters and bank drafts are absolutely safe, for if lost or stolen a re-issue or refund will be made. Those who have an account at the bank can usually obtain bank drafts on New York or Chicago without extra charge, and many banks are now issuing money orders on the same plan. Personal checks are safe, but unless drawn on a bank in some large city of the eastern or central States must include enough extra for collection. While we are quite willing to accept currency or stamps in payment, we do not advise remitting by these methods at present, for fear that such letters will also become "lost" in the mails.

* * *

For some time Dr. Rosenstock has been working up an extensive collection of ferns from southern Brazil, and the first installment is now offered for sale by the Thienemanns Buchhandlung of Gotha Germany. Through the kindness of Dr. Rosenstock we have been forwarded a parcel of these ferns and take pleasure in testifying to the fullness and excellence of the specimens. In the collection are included a considerable number of new species and varieties, making the collection an unusually valuable one. A second installment from the same collection is expected to be ready some time during the summer. Considering the quality

of the specimens, the prices are very moderate. Full information as to the make-up of the sets, prices, etc, may be had by addressing Thienemann's.

* * *

As usual, during part of the summer, the editor expects to speak on various out-door topics at several eastern Chautauquas. From July 7 to 11 he will be at the Connecticut Valley Chautauqua, Laurel Park, Mass; from July 13 to 18 at Round Lake, N. Y., from July 20 to 25 at the Connecticut Chautauqua, Plainville, Conn., and from July 28 to Aug. 5 at Pine Grove Chautauqua, Canaan, Conn. At most of these he will have charge of the nature-study work and will be glad to meet any who are interested in ferns. A special feature of the work are the daily excursions for specimens upon which many rare plants are usually discovered. At Plainville, Conn., within a radius of three miles nearly forty of the fern-worts have been found including the walking fern, the climbing fern, the cliff-brake, the adder'stongue, and two *Selaginellas*. Our readers will find that anyone of these chautauquas will afford a week's delightful outing in the company of congenial people at a very moderate cost. Information regarding rates and program may be obtained by writing Rev. G. M. Brown, Bridgeport, Conn., (for Round Lake.) Rev. E. P. Butler Sunderland, Mass. (for Laurel Park) and Rev. B. F. Gilman, Torrington, Conn.

* * *

It is difficult for those who live in the midst of ferns to imagine a region in which ferns are among the rarities, but the vast extent diversified surface and varied climate of our country make possible several

different regions that are practically fern-less. The prairie region of the Middle West, on the edge of which this magazine is now located is one of these. One might travel about Joliet all day and never find a fern. A few species may be found, however, if search is made in the right places. An outcropping ledge of limestone may yield the walking fern and the purple stemmed cliff-brake, a shaded swamp or swale may harbor the sensitive fern, and in the woods *Cytopteris fragilis* is usually present. The common and familiar ferns of the East—the cinnamon fern, Christmas fern, lady fern, and bracken—are entirely missing. Within a year or two a single small colony of *Pteris aquilina* has made its appearance along a railway and its whereabouts will not be indicated for fear somebody will dig it up. Just imagine guarding the bracken in this way in the East! By going twenty or thirty miles from the city we can find a fair number of ferns, but the conditions mentioned prevail for lesser distances. Notwithstanding this it must be said that about six miles away may be found a colony of *Pellaea gracilis* which has rarely been found so far south in any part of the world. That ferns are able to grow here is attested by the fact that in one of our public parks there is one of the best collections of ferns to be found in any city of its size. Another region that is entirely fernless is Southern Louisiana. In a flora of that part of the state recently issued by Prof. R. S. Cocks, not a single fern is catalogued. The conditions here are so different from those in Southern Florida that we wonder at the cause until we consider the physiography of the two regions. Southern Florida is built of calcareous rocks; Southern Louisiana resembles nothing so much as a vast and bottomless mud pie. Without

doubt this explains why one has an abundant fern flora and the other none at all. Large areas of the desert are also without ferns, but as a general thing ferns are not entirely missing from American deserts. Here and there a species, adapted to the rigorous conditions, finds safety and a home.

AMERICAN FERN SOCIETY.

The Society continues to increase in membership. Since the last report the following have joined us: Miss Alice M. Paine, Sebago Lake, Maine, Mrs. Edward C. Chatfield, 613 Fulton St., Minneapolis, Minn., Mrs. Thomas G. Lee, 509 River Road S. E., Minneapolis, Minn., Mr. H. Harwood Tracy, Claremont, Calif., Mr. C. Edward Jones, State Education Dept. Albany, N. Y., Mr. Charles W. Jenks, Stonecroft Farm, Bedford, Mass., Mr. Henry C. Bigelow, New Britain, Conn., Mrs. W. F. Brooks, New Britain, Conn., Mrs. Agnes M. Paxson, 64 Oak Street, Lowell,, Mass.

The following changes of address should be noted in the list of members. The address of Henry P. Walker should be 1208 Union Street, Schenectady, N. Y., that of Dr. C. E. Waters to Bureau of Soils, Washington, D. C., A. Hans, to Locust Valley, Long Island, N. Y., Miss A. D. Choate to 523 Pendleton Ave., St. Louis. Miss Mary A. Andrews, 283 Elizabeth Street, New York. Rev. S. M. Newman to Front Royal, Va.

It has been some time since the constitution of the American Fern Society was printed and it is suggested that new members would be glad to see it published in the forthcoming annual report. If there is room for it this will probably be done.

Rev. S. M. Newman who for many years has resided in Washington, D. C., has gone to Front Royal, Va., as President of Eastern College. Our Society counts among its members men of eminence in nearly all walks of life, including one who has several times been mentioned for President of this Nation but this is our first member from the list of College Presidents. The best wishes of all fern students will go with Mr. Newman in his new position.

Members who do not receive acknowledgment of dues within a reasonable time after sending will confer a favor on the Treasurer by notifying her at once, stating whether the dues were sent in cash or otherwise. Instances have come to her notice where the dues have not reached her.

The grim Reaper has been unusually busy among the members of the Society during the past year and we record with much regret the loss of Edward R. Heacock, Wyncote, Pa., Mrs. W. H. Woolworth, Youngstown, N. Y., Mrs. C. A. Pearson, Holyoke, Mass., Mr. Geo. E. Davenport, Medford, Mass., Mr. B. D. Gilbert, Clayville, N. Y. and Dr. L. M. Underwood, New York City. Biographical sketches of all will appear in the next annual Report of the Society.

Standard Books on Ferns

"How Ferns Grow," by **Margaret Slosson.** With 46 plates by the author. Large 8vo. $3.00 net, by mail $3.34.

A valuable contribution to fern literature in that it not only enables fern students to distinguish different species of mature ferns, but points out characteristics of the different kinds at all stages of development, and shows the genetic relations of ferns to each other and to the rest of plant life. The plates, nearly all reproducing ferns at their natural size, are particularly excellent. Published 1906.

"No one has hitherto devoted, as the present author does, a whole book to a readable account of the youth of ferns. . . . With great pains she has studied the various metamorphoses and has recorded in good photographs her interesting results. The transformations are all well shown by the engravings, but she has supplemented these engravings by clear text."—The Nation.

"Botanical books especially, of late years, have been remarkable for wealth and beauty of illustration, but even among these "How Ferns Grow" is notable. The pictures are purely scientific, nearly all are the size of nature, and they are so numerous and so carefully arranged as to make the text almost superfluous. . . . A beautiful book that every fern lover will want."—N. Y. Sun.

"Ferns," by **Campbell E. Waters,** of John Hopkins University. 362 pp., square 8vo. Over 200 illustrations from original drawings and photographs. $3.00 net, by mail, $3.34.

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Joliet, Illinois

Vol. XVI No. 3

The Fern Bulletin

A Quarterly Devoted to Ferns

Joliet, Ill.
Willard N. Clute & Company
1908

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Secretary, W. A. POYSER, 6028 Delancy St., Philadelphia, Pa.

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THE FERN BULLETIN

Vol. XVI JULY, 1908 No. 3

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ON CHANGES IN FUNCTION IN DIMORPHIC FRONDS.

By Willard N. Clute.

By far the greater number of ferns throughout the world produce their asexual spores on the backs of fronds that do not differ materially from other fronds devoted to purely vegetative functions. A few species, however, such as the cinnamon, sensitive and ostrich ferns have sharply separated the work of reproduction from that of food making, at least so far as this relates to the chief or sporophyte generation, and as the spore-bearing fronds have no longer use for a large expanse of chlorophyll tissue, we find them variously reduced and quite unlike the sterile fronds, or as we say, they have become dimorphic. Occasionally, too, we find this tendency to separate the two functions displayed in the same frond, as in the royal, the interrupted and the grape ferns. Usually the plants which show this latter tendency are those which commonly produce a single frond each year, as *Ophioglossum*, *Anemia* and *Botrychium*, but the phenomenon is not restricted to them as is illustrated by the *Osmundas* cited as well as by the Christmas fern and others.

That the law which determines whether a frond shall be fertile or sterile is not irrevocably fixed is seen in the instances which are steadily accumulating of fertile parts made sterile or partly sterile and what would normally be sterile parts turning fertile. We see this in that striking form *obtusilobata* of the sensitive fern, which

SEP 8 1908

is so unlike the typical plant that for a long time it was thought to be a separate species. Similar forms are found in the sensitive fern's ally, the ostrich fern, and that form of the cinnamon fern named *frondosa* is manifestly akin to them in origin. The common rattle-snake fern (*Botrychium Virginianum*) frequently exhibits such forms, though since it has but a single frond, it must perforce change only a part of the pinnae. Through the kindness of Messrs. James Shepard and H. C. Bigelow, I am able to illustrate in the frontispiece a specimen collected near New Britain,

STERILE PINNA OF BOTRYCHIUM VIRGINIANUM BEARING SPORANGIA

Conn. in which some of the normally fertile pinnae have reverted to leafy parts, while an accompanying drawing from a plant colected in Indiana by Mr. F. C. Greene, shows the reverse of this in which some of the leafy parts have become spore-bearing.. So well are the principles underlying the production of these reversions now known that several of them can be made at will by the experimentor.

In connection with this may be found the answer to the question: which was first, the spore-bearing or leafy parts of the fern? Botanists are pretty well agreed that ferns have arisen from some moss-like ancestor. All the evidence points toward this conclusion.

In the mosses, however, the gametophyte—that part which corresponds to the prothallium of ferns—does practically all the work of food-getting and supports the spore-bearing generation—which is equivalent to the ordinary fern-plant—throughout its existence.

Our ferns, of course, are self-supporting except for a brief period in infancy when they are dependent upon the gametophyte exactly as the spore-bearing parts of the moss are for life. It will thus be seen that the office of bearing spores was selected for the fern plant long before it needed to secure its own living and the first step toward an independent existence was undoubtedly made by turning part of the spore-bearing tissue into a green blade for vegetative functions. Some of our simplest fern-worts still point to the way in which fern fronds were evolved by being little more than a cluster of spore-capsules with some rudimentary green leaf-like parts.

Thus it may be seen that when a fern frond that is normally fertile becomes sterile, it has but followed a precedent set for it since time began for the ferns, while a sterile part that becomes fertile is the only one that may be said to *revert* to a former condition, though curiously enough, we customarily refer to fertile parts becoming sterile as true cases of reversion.

Just how late in the history of any given frond it is able to change from fertile to sterile or *vice versa* does not seem to be very definitely known. Probably the power to make the change exists until the cells have nearly ceased to multiply. Ferns belong to a class which the old botanists knew as Acrogens, or tip-growers from the fact that the region where new cells are produced is at the apex. As a consequence of this method of growth, the basal parts of fern fronds are

formed first and therefore should lose their plasticity long before the tip does so. As a matter of fact, this is shown in practically all these curious changes, for when a fertile frond becomes partly sterile, it is the newer tip that makes the change. If any part is fertile it is likely to be the lower parts as shown in our illustration. It is well known that fern fronds are completed, so far as the making of additional cells is concerned, for some time before they appear above the earth, their subsequent development being largely an increase in the size rather than in the number of the cells, so that when the frond is fully formed it is doubtless incapable of change though it may not be destined to be unfurled for months to come. In many ferns the sporangia are developed from single cells on the surface of the frond and it may be possible that in such species the power to produce spores exists even after the frond is formed, but nothing very definite seems to be known on this point.

FERNS OF BLOOMINGTON, INDIANA.

By F. C. Greene.

Bloomington, the seat of Indiana University, is situated in the great Mississippian limestone belt of southern Indiana. However, the Knobstone, with its deep, shaded ravines and dry points, is found less than a mile to the east, while large cliffs of sandstone occur a few miles to the west. Each locality adds variety to the fern flora, although many species are common to all three.

A short walk in any direction will be almost sure to disclose *Cystopteris fragilis, Phegopteris hexagonoptera, Adiantum pedatum, Polystichum acrostichoides* and *Botrychum Virginianum.* The deep Knobstone ravines contain luxurious plants of *Asplenium angusti-*

folium, Athyrium thelypteroides and *Nephrodium goldieanum*. Higher up on the knobs, particularly on shaded northern slopes, *Nephrodium marginale, N. Noveboracense* and *Athyrium filix-foemina* are found.

Blatchley has recorded *Ophioglossum vulgatum* from Huckleberry Hill, a dry Knobstone point to the northeast, and there is no doubt as to the authenticity of the record although several searches have failed to reveal it to the writer. The knobs yield, in favored places, three more species which appear to be rather rare namely *Pteris aquilina, Asplenium ebeneum,* and *Osmunda regalis*. In the limestone region, the edge of a cliff sometimes reveals *Woodsia obtusa*, while *Camptosorus rhizophyllus* commonly covers detached boulders at the foot of the cliff. One locality known as Cedar Cliff affords specimens of *Pellaea atropurpurea*. Near the head of a ravine, in the refreshing spray of a small waterfall, is the most luxurious colony of *Cystopteris bulbifera* it has ever been my pleasure to see.

Botrychium obliquum and *Onoclea sensibilis* are found on the Campus of Indiana University besides other places near Bloomington.

While there are no marshes in the vicinity, *Osmunda claytoniana* is occasionally found. There is also an authentic record of *O. cinnamomea* from the bottoms of the Bean Blossom, a creek northeast of Bloomington. The sandstone region to the west is extremely rich in ferns, one small glen furnishing eleven species, among which were *Polypodium vulgare* and *Nephrodium spinulosum intermedium*. This makes, altogether, a list of twenty-five species, all but two of which have been found by the writer and Mr. I. M. Lewis within the last year.

New Albany, Ind.

THE FAMILIES OF FERN-LIKE PLANTS.

Many botanists divide the plant world into four groups, the Thallophytes, Bryophytes, Pteridophytes and Spermatophytes which include respectively the algae and fungi, the mosses and liver-worts, the ferns and fern allies, and the conifers and flowering plants. So greatly do the plants differ, however, that this arrangement is becoming more and more unsatisfactory and various rearrangements have been suggested. In "University Studies" for October, 1907, Prof. Charles E. Bessey of the University of Nebraska offers a plan in which, instead of the four divisions, fifteen are proposed. Whatever objection may be brought against the new arrangement, it is certain that it comes more nearly representing the correct relationships of the plants than those now in use. Since the fern and fern allies are the living representatives of those plants which have bridged the gap between the lower spore-plants and the flowering plants, we append Prof. Bessey's arrangement of the entire group both living and fossil, slightly abridged as to descriptions beginning with the ninth division or phylum which is the one next higher than the mosses. The unfamiliar technical terms in the descriptions of the orders will be made clearer by a re-reading of the article "But Half a Fern" in the January number of this magazine.

Phylum IX. PTERIDOPHYTA. The Ferns.

Chlorophyll-green, mostly terrestrial plants, exhibiting two generations in each life cycle, viz: (1) the gametophyte, which is small and short-lived, and (2) the sporophyte which is large with roots, stems and leaves and long-lived.

CLASS 20. EUSPORANGIATAE.

Order Ophioglossales. Gametophyte tuberous, chlorophylless, subterranean; sporophyte with large often compound sporophylls (leaves) certain branches of which are spore-bearing.

Family 1.—Ophioglossaceae. *Ophioglossum, Botrychium.*

Order Marattiales. Gametophyte flat, chlorophyllose, attached by rhizoids; Sporophyte with large, compound sporophylls.

Family 2.—Marattiaceae. *Angiopteris, Marattia, Danaea.*

Order Isoetales. Gametophyte dioecious, the male rudimentary, one celled, very small; the female larger, many called, but little larger than the megaspore; sporophyte with an erect stem bearing many crowded, narrow sporophylls.

Family 3.—Isoetaceae. *Isoetes.*

CLASS 21. LEPTOSPORANGIATAE.

Order Filicales. Spores of one kind; sporangia mostly with an annulus (ring); gametophyte monœcious, foliose.

Family 4.—Osmundaceae. *Osmunda, Todea.*

Family 5.—Schizaeaceae. *Schizaea, Anemia, Lygodium.*

Family 6.—Gleicheniaceae. *Gleichenia.*

Family 7.—Matoniaceae. *Matonia.*

Family 8.—Parkeriaceae. *Ceratopteris.*

Family 9.—Cyatheaceae. *Dicksonia, Cythea, Alsophila.*

Family 10.—Hymenophyllaceae. *Hymenophyllum, Trichomanes.*

Family 11.—Polypodiaceae. *Polypodium, Asplenium, Nephrodium.*

Order Hydropteridales. Spores of two kinds, microspores and megaspores; sporangia without an annulus; male gametophyte one-celled, minute; female gametophytes larger, many-celled but little larger than the megaspore.

Family 12.—Marsiliaceae. *Marsilia, Pilularia.*

Family 13.—Salviniaceae. *Azolla, Salvinia.*

Phylum X. CALAMOPHYTA. The Horsetails.

Chlorophyll-green terrestrial plants, exhibiting two generations in each life cycle, viz: (1) the gametophyte, which is small and short-lived, and (2) the sporophyte which is large with roots, leaves and stem and long-lived. Stems of the sporophyte solid or hollow, jointed, erect or creeping, leaves whorled, relatively small.

CLASS 22. SPHENOPHYLLINEAE.

Order Sphenophyllales. Palaeozoic plants of tree-like aspect and dimensions, long since extinct. Stem solid, jointed, bearing relatively small wedge-shaped leaves; sporophylls in cones, each sporophyll with one or two isosporous sporangia.

Family 1.—Sphenophyllaceae. *Sphenophyllum.*

CLASS 23. EQUISETINEAE.

Order Eqisetales. Palaeozoic to recent plants, mostly extinct. Stems hollow, jointed; leaves very small, narrow, and united into a sheath; sporophylls peltate, in close terminal cones, each sporophyll with several pendant isosporous sporangia.

Family 2.—Equisetaceae. *Equisetum, Equisetites* (extinct).

CLASS 24. CALAMARINEAE.

Order Calamariales. Palaeozoic plants, often of tree-like aspect and dimensions, long since extinct. Stems, hollow, jointed; leaves mostly narrow distinct; sporophylls in cones, each sporophyll with one or more heterosporous sporangia.

Family 3.—Protocalamariaceae. *Asterocalamites.*

Family 4.—Calamariaceae. *Calamodendron, Eucalamites.*

Phylum XI. LEPIDOPHYTA. The Lycopods.

Chlorophyll-green, terestrial plants, exhibiting two generations in each life cycle, viz: (1) the gametophyte which is small and short-lived, and (2) the sporophyte which is large, with roots stems and leaves and long-lived. Stems of the sporophyte solid, not jointed, erect or creeping; leaves relatively small, scattered or crowded upon the stem.

CLASS 25. ELIGULATAE.

Order Lycopodiales. Gametophyte much larger than the spore; sporophyte with a central vascular bundle; spores uniform (isosporous).

Family 1.—Lycopodiaceae. *Lycopodium, Phylloglossum.*

Family 2.—Psilotaceae. *Psilotum, Tmesipteris.*

CLASS 26. LIGULATAE.

Order Selaginellales. Sporophyte stem with a central fibro-vascular bundle incapable of thickening; spores of two kinds (heterosporous).

Family 3.—Selaginellaceae. *Selaginella.*

Order Lepiodophytales. Sporophyte stem with a central fibro-vascular bundle and thickening by a cortical meristem. Palaeozoic and Mesozoic trees, long since extinct.

Family 4.—Lepidodendraceae. *Lepidodendron, Lepidophlois.*

Family 5.—Bothrodendraceae. *Bothrodendron.*

Family 6.—Sigillariaceae. *Sigillaria.*

Family 7.—Pleuromoniaceae. *Pleuromonia.*

PHYLUM XII. CYCADOPHYTA. THE CYCADS.

Chlorophyll-green, terrestrial plants in which the alternation of generations is obscured by the reduction of the gametophyte to a condition of dependence upon the long-lived, leafy-stemmed sporophyte; spores of two kinds, borne in sporophylls, the microspores set free, the megaspores retained in their sporangia where they develop gametophytes.

CLASS 27. CYCADOFILICES. (Pteridospermeae)

Family 1.—Lynginopterideae. *Lyngiopteris, Megaloxylon.*

Family 2.—Medulloseae. *Medullosa, Steloxylon.*

Family 3.—Cladoxyleae. *Cladoxylon, Voelkelia.*

Family 4.—Protopityeae. *Protopitys.*

Family 5.—Araucarioxyleae. *Araucaryoxylon.*

CLASS 28. CORDAITINEAE.

Family 6.—Cordaitaceae. *Cordaites, Dadoxylon.*

CLASS 29. BENNETTITINEAE.

Family 7.—Bennettitaceae. *Bennettites.*

CLASS 30. CYCADINEAE.

Family 8.—Cycadceae. *Cyas, zamia.*

CLASS 31. GINGKOINEAE.

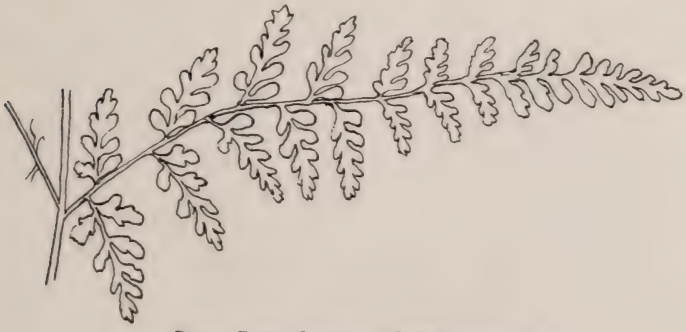
Family 9.—Gingkoaceae. *Gingko.*

PHYLUM XIV. STROBILOPHYTA. THE CONIFERS.

RARE FORMS OF FERNS.—VII.

A Slender Leaved Cystopteris.

The brittle bladder fern (*Cystopteris fragilis*) is distributed practically throughout the world. From Alaska and Iceland to the tropics, from Japan and Siberia to the Cape of Good Hope, from sea level to altitudes of more than three miles above it, on wet or dry rocks and its woods, it finds a home. The varying habitats to which it has been obliged to adapt itself have not failed to leave their impress upon the plant in the shape of changed form in the fronds and altered stature, yet through all these vicissitudes it has man-



Basal Pinna Reduced One-Fourth.

aged to maintain its characteristic features so nearly unchanged that all the varying forms are still considered as belonging to a single species. The differences exhibited by different plants, however, have not failed to confuse the systematists and in looking up the synonmy of the species, one finds that no less than twenty-five different names have been given to it. In view of these facts, one must be confident, indeed, who would venture to describe a new form, but the specimen which is illustrated herewith is so markedly dif-

ferent from any that have been named before that I feel warranted in naming it

CYSTOPTERIS FRAGILIS TENUIFOLIA sub-sp. nov.

Stipes 4 to 6 inches long, brownish; blade lanceolate 10 to 14 inches long, 6 to 8 inches broad, bipinnate; primary pinnae distant, about ten pairs 1 to 1½ inches broad at base tapering to a slender tip; secondary pinnae lanceolate deeply cut into four or more pairs of obovate segments; sori one to each segment, large for the genus; indusium, heavy, persistent. Found in rich soil, Carr Canyon Huachuca Mountains, Arizona by James H. Ferriss, November 1907. Type in my herbarium.

In appearance this is very distinct from the ordinary forms of *Cystopteris fragilis*. The type is described as having fronds from 4 to 8 inches long and 1 to 2½ inches broad. This is more than twice as long and three times as broad. A distinguishing feature of the type is found in the secondary pinnae which are decurrent on the rachis but in this the wing is not visible to the unaided eye. Unlike the type, also, this grows upright in rich soil instead of more or less spreading on rocks. Specimens identical with this were collected many years ago in Conservatory Canyon by J. G. Lemmon who also noted its deviation from the type. Although his labels read "A very curious form," he neither named nor described it. Conservatory Canyon is only a few miles distant from Carr Canyon and it is probable that the fern is not uncommon in the region. Without doubt the plant owes its slender pinnules and marginless rachis to the conditions which prevail in its habitat, but it is a strongly marked plant that apparently does not intergrade with the type and which

does not grow in the same situations; in fact, the ordinary *Cystopteris fragilis* does not appear to occur at all in this region. Since recent rules of nomenclature make special inducements for changing the names of plants when the plant is changed from variety to species, it may be observed that this plant may also be called *Cystopteris tennifolia,* and *Filix fragilis tennifolia.*—W. N. C.

A QUESTION OF NOMENCLATURE.

BY A. A. EATON.

The editor of the *Bulletin* seems to enjoy the unique position of being the only person who at present adheres to the principle that a name given to a variety must be retained if the variety becomes a species, and inversely a name given to a species must be retained if the species is reduced to a variety. Article 49 of the Vienna Code reads in part: "When a subdivision (variety) of a species becomes a species, or the reverse; and generally speaking, when a group changes its rank, the earliest name received in its new position must be regarded as valid." It is *recommended,* however, that the old name be carried over. This is one of the few points in which the Vienna and American codes agree. Indeed, Dr. Underwood in conversation with me singled it out as the only rule of the Vienna Code that was worthy of adoption. Let us illustrate this rule by instances in recent numbers of the *Fern Bulletin.* Several years ago I described *Isoetes Dodgei.* Later, when I had access to Dr. Engelmann's material, I found it to be his *I. riparia* var. *Canadensis.* Doubtless the only reason Dr. Engelmann made this a variety was because his material was rather under-ripe and

he thought it safer to do so. When I found the two names represented the same thing, I changed *I. Dodgei* to *I. Canadensis,* as I then held the view which the editor holds, that the earliest name, of whatever rank, must stand. According to all codes of nomenclature but the editor's, however, *I. Dodgei* must be the name of the species as it is the first name of specific rank the plant bore.

In the *Bulletin* for January, 1908, p. 18, No. 227 of the fern list,*Equisetum hiemale robustum* (A. Br.) is given as the name which we must suppose the editor countenances, but he says further on: "It may be noted that the correct name for this plant is *E. hiemale prealtum* (Raf.)." Aside from the question of morals involved in making combinations in this off-hand way, which must perhaps be called citation in synonymy, the name proposed violates article 49 of the Vienna Code in that *E. hiemale* var. *robustum* was the first combination for the plant in its present rank. When dealing with this plant in the *Fern Bulletin* articles I ignored Rafinesque's name because of the uncertainty as to what species it should be applied. Since then, however, I have become convinced by the process of elimination that it applies to the plant named *E. robustum* by A. Braun, and if it were a good species we should use Rafinesque's name: but it is simply a variety of *E. hiemale* and must retain the name first applied to it as such; *E. hiemale* var. *robustum.* The recent great upheavel of nomenclature has been for the purpose of arriving at uniformity. On the question under discussion the two major codes are agreed, and their adherents will work in harmony. I write this note that the readers of the *Bulletin* who have not the means in keeping in touch with the larger affairs of

botanical activity may know that on this point, as on many others, the editor's code represents himself alone. Whatever may be said in regard to controverted nomenclatorial points, upon which codes differ, it would hardly be deemed advisable to take exceptions to those points on which there is unanimity. If everyone with a pet theory insists on embodying it in practical usage we shall have a condition of anarchy in which no one can understand current botanical literature without a voluminous card catalog for reference.

The Ames Botanical Laboratory.

[The foregoing is an excellent example of the reasoning that some people adopt to convince us that a species once named is not named. One can make rules for anything, but this does not prove that they are right. Mr. Eaton and his friends seem to have a code which assumes that the editor belongs to a different species because he does not subscribe to all the absurdities their rules require, but we are inclined to think that the differences are only varietal. As to the editor being the only person who objects to changing the names of plants to accommodate those who would write their own names after them, this seems to be a misunderstanding upon the part of our critic. You can stand a man so near a cathedral that he can only see the bricks and stones right in front of him and misses entirely the beauty of the whole. So, too, one can contemplate his own brand of nomenclature so closely that he cannot see the relationships of the whole subject in proper perspective. This seems to be the trouble with our correspondent. The facts in the *Isoetes* case from our angle are these: Engelmann found a plant and gave it a name. Eaton later found the same form, did not recognize it and gave it

another. Now because Eaton was mistaken we are asked to change the name of the plant, the excuse for the change being that in giving the new name, Eaton disagreed with Engelmann as to the amount of difference between it and the nearest related form. *"I. Dodgei* must be the name of the species as it is the first name of specific rank the plant bore," may be good enough logic for those who change names to get their own into print, but the editor's "code" as outlined by Mr. Eaton reads *"I. Canadensis* must be the name of the species because it is the name first given to the plant," and the editor is ever ready to maintain that if a few botanists can form an "American Code" in defiance of the Vienna Code that all the rest of the world has agreed upon, he has quite as much right to form a "Fern Bulletin Code" or an "Editorial Code." This magazine and its editor, however, are not trying to make an impression upon botanical nomenclature, but instead are endeavoring to use the terminology that squares most readily with common sense. In the case of the great scouring rush mentioned, we never considered "making combi in this off-hand way" very demoralizing except perhaps to the peace of mind of those who consider nomenclature a god or master instead of a servant. If our critic really believes that "the earliest name received in its new position must be regarded as valid" we wonder why he takes the trouble to get excited over this "off-hand way" of stringing latin words together to indicate a mere form. Mr. Eaton may, as he claims, have been convinced by the process of elimination that the name *prealtum* applies to the plant in question, but he might have saved himself considerable mental effort by turning to Vol. XI. No. 1 of *The*

Fern Bulletin where the name and its application are set forth by Prof. R. S. Cocks. In Mr. Eaton's treatment of *Equisetum hiemale* in this magazine, we fail to find any mention of this correct first varietal name of the plant. While we have the highest regard for Mr. Eaton, personally, we have many instances to show that his judgment is not infallible and occasionally prefer to think for ourselves. "Those who have not the means to keep in touch with the larger affairs of botanical activity" are at liberty to take what opinion they choose or to make a new one for themselves. The editor's aim is to advance fern study, not to club it into a straight-jacket of nomenclature. We trust that Mr. Eaton will continue to favor our readers with his view of such matters.—*Ed.*]

THE CHECK-LIST OF NORTH AMERICAN FERNWORTS.

By Willard N. Clute.

The completion of the check-list of our fernworts makes it possible to get a better idea of our fern flora than could be had heretofore. The list is what might be termed a conservative one. Only such plants as seemed fully entitled to specific rank were given the dignity of a generic and specific name, and of these there are 196 ferns and 70 fern allies. Strongly marked forms, such as *Nephrodium spinulosum dilatum*, have been considered sub-species and given three names, of these there are 19 among the ferns and 8 among the allies.

In the number of forms listed, the Check-list is far ahead of any other list published. An effort has been made to include every variation from the normal

that has been thought worthy of a variated name. Of these there are no less than 121 among the ferns and 82 among the allies. A large majority of these have been described in the past few years, and many of them represent merely small changes in the texture and cutting of the leaves due to variations in the habitat of the plant. Still others are forms that were once considered species but which further study has shown to be unentitled to rank as such.

It was inevitable that while this list was being printed a number of new forms and species should have been added to our flora. These have been listed below with places of publication given when the forms are new.

ADIANTUM HISPIDULUM f. STRICTUM Gilbert. Fern Bulletin, O. 1905.

ACROSTICHUM LOMARIODES f. LOBATUM A. A. Eaton Torrey Bulletin, 1906.

ASPIDIUM CICUTARIUM Baker. (*Tectaria coriandrifolia.* Und).

ASPIDUM TRIFOLIATUM AMESIANUM (A. A. Eaton). Torrey Bulletin, 1906. (*Tectaria Amesiana* A. A. Eaton.)

ASPIDIUM TRIFOLIATUM MINIMUM. Underw Torrey Bulletin, 1906. (*Tectaria minima* Underw.)

ASPIDIUM TRIFOLIATUM HERACLEIFOLIUM (Willd). *Tectaria heracleifolia* (Willd).

ASPLENIUM FERRISSI Clute. Fern Bulletin, Ja. 1908.

ASPLENUM TRICHOMANES X RUTA-MURARIA Dav. Rhodora, Ja. 1906.

DICKSONIA PILOSIUSCULA f. NANA Gilbert. Fern Bulletin, O. 1905.

LOMARIA PROCERA Spreng. *Stenochlaena Kunzeana.* (Presl).

NEPHRODIUM CLINTONIANUM f. SYLVATICUM W. A. Poyser. Fern Bulletin, Ja. 1908.

OSMUNDA REGALIS f. ORBICULATA Clute. Fern Bulletin, Ja. 1908.

POLYPODIUM VULGARE f. ALATO-MULTIFIDUM Gilbert. Fern Bulletin, O. 1906.

POLYPODIUM VULGARE f. AURITUM Willd.

POLYSTICHUM ACROSTICHOIDES f. MULTIFIDUM Clute. Fern Bulletin, Jl. 1907.

SCHIZAEA GERMANI. (Fee). *S. pennula* Sw.

STRUTHIOPTERIS GERMANICA f. PUBESCENS Terry. Fern Bulletin, Ja. 1908.

SUMMARY.

Numbered ferns in the list	211	
Numbered Fern Allies in list	86	
Total		297
Forms of ferns not numbered	121	
Forms of fern allies not numbered	82	
Total number of forms		203
Species and sub-species added herewith	7	
Forms added herewith	11	
Total number added		18
Grand total		518

Species in Stebbins' list 1878	147
" " D. C Eaton's list 1880	167
" " Davenport's list 1883	188
" " Fern Chapter list 1895	249
" " Maxon's list 1901	307
" " Gilbert's list 1901	438
" " Fern Bulletin list 1908	518

The great interest that is now being manifested in the study of the forms of ferns is likely to annually add other items to this list for many seasons to come. It is not likely that many more species of ferns new to science will be discovered in our region but species new to the region, may still be expected from our southern border. There is practically no end to the number of forms that may be discovered and this form of fern study is bound to prove fascinating since it does not require extended expeditions into unsettled regions for its pursuit.

FRUITING OF BOTRYCHIUM.

BY MRS. A. E. SCOULLAR.

Very near our camp at Standish, Maine, is an old fence row where many *Botychiums* are found. Following the suggestion of Mr. Waters in "Ferns," Mr. Scoullar and I determined to watch the fruiting of one each of the following plants (selecting in each instance the most robust and marking them, so that no mistake could be made in identification). I submit this report hoping it may prove of interest. We will continue our observation of the same plants. We are also watching a plant that has not borne fruit for three years and has changed in the cutting of its frond each season.

Botrychium matricariacfolium: June 15, 1904 (fertile), June 18, 1905 (two fruiting spikes) June 16, 1906 (sterile) June 21, 1907 (fertile).

Botrychium obliquum: Aug. 25, 1904 (fertile). Sept. 1, 1905 (fertile) Sept. 7, 1906 (fertile). Sept. 7, 1906 (fertile). Sept. 5, 1907 (sterile).

Botrychium obliquum dissectum: Aug. 20, 1904 (fertile). Sept. 1, 1905 (fertile). Sept. 8, 1906 (sterile). Sept. 10, 1907 (two fruiting spikes).

[This is an excellent contribution to our knowledge of these fern-worts, and an example of careful work that might be followed with profit by others. It seems likely from the above, that in these plants, as in others, heavy fruiting is followed by a sterile year. We are ready to mark the second species fertile in 1908 and the third species sterile in advance of the promised report.—Ed.]

POLYPODIUM VULGARE AURITUM.

I think before you give Mr. Henry Merrill, of Hiram, Me., the honor of finding *Polypodium Vulgare auritum* you had better consult some back numbers of *Rhodora*. Several years ago I found this fern here and Mr. Fernald, of Harvard, identified the same as variety *auritum*. I have known of people before who thought that the finding of a large station of a plant was of vastly more value, that finding the species for the first time by some other collector. The plant figures as one in the list of Maine ferns and I furnished the station and reported the same to Dr. Fellows, of Portland. Don't try and take away the honor from the man who found the first station in the state of Maine. At the time I sent the plant to Mr. Fernard, he told me it was the second time it had been reported from North America, so Mr. Merrill's station is third. I think an apology is due in your paper for trying to give Mr. Merrill an honor which he in no way deserves or is entitled to if the law of priority means anything. I have another form of *P. Vulgare*, which I have named *Polypodium vulgare* forma *elongata* Jewell. The form

grows in small quantities of earth in crevices of ledges four inches in length half an inch wide from the middle of frond and an inch and a half from the middle to the base of frond. I have other forms that are somewhat out of the ordinary. *Phegopteris dryopteris* forma *interrupta* Jewell is a form in which the two lower pinna are nearly two inches below the second pair, giving the plant a queer look.

H. W. Jewell, Farmington, Maine.

[Mr. Jewell read that paragraph in the April 1907 *Fern Bulletin* too hastily. A second reading will show him that Mr. Merrill distinctly states that his find is the second one for the state. This second find, however, is not so important as the find of *P. v. hastatum* a form new to the state. Of course the patient editor apologizes for even seeming to cast a shadow upon Mr. Jewell's honors—that is what many people think an editor is for. He cannot help adding, however, that honors of this kind will settle more thickly upon his correspondent when he learns to forsake the daily newspaper and publish his finds in a reputable scientific journal.—*Ed.*]

PTERIDOGRAPHIA.

The Common Brake as Food.—A nursery some time back sent me a packet of the dried material with directions for cooking and after soaking and boiling for the specified time a soft and by no means unpleasantly tasting dish resulted. In this connection, why *Pteridium* in this case and the only really recognized name *Pteris aquilina* in the succeeding article. This and many other instances demand a dose of editorial blue-pencil as per the editorial note on page 61.—*Chas. T. Druery, F. L. S., London.* [There are many reasons

why we occasionally use *Pteridium* instead of *Pteris*. Variety adds to the spice of life, we are told, and what is the use of sticking to one term when the name-tinkerers have given us more. The English language owes not a little of its expressiveness to its abundant synonyms, then why should we use *Lastrea* all the time when we have a choice of *Nephrodium* and *Aspidium* and *Dryopteris* and then some more? Or why stick to *Polypodium* when we may use *Phegopteris, Goniopteris* or even *Dryopteris?* To come down to well-known facts, the bracken has a sort of fugacious indusium inside the common one. The genus *Pteris* lacks this; therefore the bracken is often considered worth placing in a separate genus. The editor of this magazine does not believe that so small a matter as the occasional presence of a fugacious indusium is of generic importance but if his contributors do, he lets them have their own way confident that they will reform in due time.—Ed.]

Ferns as Food Preservers.—An item has recently appeared in several horticultural publications to the effect that fern leaves are much superior to any other vegetation for packing fruit, vegetables, butter, etc. According to "Consul-General Richard Guenther" potatoes packed in fern leaves keep much better than if packed in straw which is due to the high percentage of salt in fern leaves. To one familiar with the ferns, this appears like a story made to fit the facts. It is well known that various fruits fish and vegetables have been sent to market from time immemorial packed in fern leaves, but this is without doubt due to the fact that such packing material is usually both cheap and handy rather than because it contains any substance that acts as a preservative. As a matter of fact, most fern leaves, being adjusted to a shady, rather than to

a sunny, habitat, are likely to wilt rapidly and thus form but an indifferent packing so far as keeping products fresh is concerned. Ferns, especially the bracken, are of much more extended use in packing in Great Britain than with us, and the people are not allowed to cut brackens when and where they please. The whole subject is one of considerable interest and we hope some of our British readers may give us more light on the subject.

Fern Genera.—I am pleased at the attitude you take on the nomenclature question. It is the only sensible one. I have recently been looking up fern genera and the changes that Underwood made in species because of so called priority. It is astonishing how many blunders he made. Take *Filix* for *Cystopteris* for instance, and *Drypoteris* for *Aspidium.* They are based on Adanson's genera created in his Fam. des Phlantes. So far as I can learn no species of *Filix* ever was published till Underwood renamed *Cystopteris;* at least none were published till long after the species of *Cystopteris* were. It should be noted that Adanson never published any species in connection with his proposed genera and so the genera fall without someone else took them up and used them later. The same is true of *Dryopteris;* no species of that genus were published till long after Swartz published his species of *Aspidium*, and so *Dryopteris* falls. In addition there is nothing in Adanson's description of *Filix* to tell whether it refers to *Phegopteris* or *Cystopteris,* and none in *Dryopteris* to indicate whether it refers to *Nephrodium, Phanerophlebia* or other segregates from *Aspidium.* He speaks of the indusium as being peltate, while it is not so in *Aspidium.—Marcus E. Jones, Salt Lake City, Utah.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from this list.

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SHEPARD, J. *Solar Prints of Plants.* Illust. Fern Bulletin, Ap. 1908.—A new method of making prints of ferns without a camera described.

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WATERS, C. E. *Equisetum hyemale.* Fern Bulletin, Jl. 1907.—Reprint from *Linnaean Fern Bulletin,* No. 6.

WATERS, C. E. *Notes on Aspidium cristatum.* Fern Bulletin, Jl. 1907.—Reprint from *Linnaean Fern Bulletin* No. 1.

A NEW FORM OF POLYPODY.—In the *Maine Woods* for March, 1908, H. W. Jewell describes a new form of the common polypody as *Polypodium vulgare f. elongata.* A blue-print of the form shows it to consist of five or six pairs of pinnae, longest at the base and rapidly diminishing upward ending in a long terminal segment that is deeply lobed below to meet the pinnae. The whole fern is not more than five inches in height and was collected in a rock crevice. The scanty moisture in such a situation is doubtless responsible for the form of the plant, which in most respects, corresponds to young phases of the ordinary species. Since there have already been named six different *elongatums* in *Polypodium* this fern would doubtless need a new name if distinct enough to merit one, but the describer should select some other place of publication than a newspaper, and get his adjectives to agree with his nouns.

EDITORIAL.

The missing number of this magazine for October 1907 is partly in print at this writing, but it will not be sent out until the October number for this year is ready when the two will be sent together. At the same time the title pages and tables of contents for volumes 12, 13, 14 and 15, which have been promised so long, will be issued, but since some of our subscribers do not bind the magazine, and therefore do not care for the title pages, copies of these will not be sent out to our regular list. Copies will be sent to all public libraries and scientific institutions without further notice because these carefully preserve the magazine, but others who wish the title-pages are requested to indicate the fact. The pages are absolutely free and postpaid and all that is needed to secure them is a request at any time.

* * *

A complete set of the FERN BULLETIN has recently been acquired by C. Belhatte, 7 Rue Fresnel, Paris, France. This is the only complete set of the magazine in the Old World and will doubtless be valued accordingly. It also adds one more to our list of complete sets making twenty-nine in all. The herbarium in which M. Belhatte is in charge is the largest in France containing about 25,000 sheets of ferns and more than a million flowering plants. He is desirous of adding more tropical ferns to his collection and offers in exchange for them, European plants, botanical works or cash.

* * *

A feature of fern study that has not, as yet, been very extensively exploited in America, is the search for

forms of ferns of commercial value. In Europe this appears to be one of the main indications of an interest in ferns and in consequence the named varieties are almost limitless. Often the appearance of the cultivated forms are scarcely attractive from the point of view of beauty, but their odd shapes seem to please the public for it may be observed that if our own florists cultivate any of these European forms they almost invariably select the crested, tasseled and frilled specimens. It cannot be denied that variation along certain lines adds to the beauty of an already beautiful race of plants. Illustrations of this may be seen in the many sports of the sword fern (*Nephrolepis exaltata*) all of which are undoubtedly more beautiful than the type, and in "*Adiantum farleyense*" which is well known to be a sport from a species that is not celebrated for its appearance. Since most of our greenhouse ferns are tropical in origin, the search for desirable forms will go on most vigorously in the tropics and may lend zest to every outing, but such fern hunting need by no means be restricted to the tropics. The demand is steadily increasing for the ferns of temperate regions, hardy enough to endure our winters out of doors unprotected, and if people are willing to pay for the Christmas fern, the ostrich fern and the *Osmundas* as they are, surely they will pay more for improvements in these forms, perhaps even coming to the point when they demand the new form and refuse the type, as they now do in the case of the so-called Boston fern. Mr. Terry's *multifidum* form of the Christmas fern is one that would always be selected in preference to the type and the same may be said of various forms that Mr. Hans has produced; indeed a decided and characteristic form of *Polystichum acrostichoides incisum* would no

doubt sell well, as would a crested form of the lady fern or the *Dicksonia.* There is a satisfaction in giving to the world a more beautiful form of anything than it now possesses, quite aside from any monetary consideration, but when art, beauty and commerce join forces, the student of ferns has cause to rejoice.

* * *

Publication of the fern floras of the States has not been given up, and several new ones are being prepared. The issuing of the floras for the States at the extremes of our range, such as California, Washington, Maine, Florida, Vermont, Texas and Louisiana, have shown us a great deal regarding the distribution of species as regards the country as a whole, but there are various minor problems of distribution which the forthcoming floras may be expected to elucidate. This is especially true of the States in the Mississippi Valley where the Eastern and Western floras meet, and of those on the borderland where Northern and Southern species intermingle. In time all these will appear, but in many the observers are so few that considerable work will have to be done before anything like completeness in the list can be attained.

BOOK NEWS.

In "Contributions from the United States National Herbarium" Volume X part 7, issued March 30, 1908, appears the first of a series of "Studies of Tropical American Ferns" by William R. Maxon. Mr. Maxon has spent more time collecting in the tropics than any other American student of ferns and it is very fitting that he should take up the work of making the species better known. The initial study, however, has a considerable tinge of the book work that always results in

new ways of distinguishing tweedledee form tweedledum. For instance, when Linnaeus made the name *Asplenium rhizophyllum* he seems to have had three plants in mind, the American walking fern, the Siberian species and the very characteristic Jamaican fern which has since been known as *Fadyenia prolifera*. The connecting of the specific name *rhizophyllum* with our species of *Camptosorus* of course left the Jamaican plant without a name, and in 1840 Hooker called it *Fadyenia prolifera*, taking as the specific name the name given by Swartz to this plant 120 years ago. Unfortunately, Lamark, two years earlier, gave the same specific name to an *Asplenium* but although his name never gained currency, we are now asked to substitute *Hookeri* for the long-used specific name. But doctors disagree in this case, as usual, and Christiansen's recent "Index" uses the specific name *Fadyenii!* A similar complication gives occasion for a new name for *Polypodium crassifolium*. When it could no longer rest easy as a *Polypodium* Schott called it *Anaxetum*. Fee declined to accept this because the name had once been applied to a genus of Composites, and called it *Pleuridium*. Maxon now objects because this latter name has been given to a genus of mosses and suggests *Pessopteris*. To make ourselves understood we must still use *Polypodium*. For similar reasons *Anathacorus* is a new generic name suggested for certain species usually regarded as belonging to *Vittaria*. Fourteen ferns in various genera are described as new and no less than fifteen names given to ferns by older botanists have been so re-arranged as to have Maxon's name in the author citation. Mr. Maxon's knowledge of the plants in the field and his situation in a great herbarium gives him unusual facilities for an exact account

of tropical ferns, and we venture the hope that he may find time to take them up, genus by genus, and give us correct descriptions of the known species without too much consideration of what they might have been called by botanists who have been dust for a century or more.

AMERICAN FERN SOCIETY.

Since the last report, the American Fern Society has gained three additional members as follows: F. T. Pember, Granville, N. Y., Harry C. Ridlon, Cuttingsville, Vt. and Samuel A. Lurvey, Southwest Harbor, Maine. These will be included in the new list of members to be published in the Annual Report which it is hoped may soon be issued. The address of Dr. C. E. Waters, should be Bureau of Standards, Washington, D. C., instead of Bureau of Soils as recently printed.

The annual election of the Society occurs as usual in October. The committee in charge of the selection of candidates for office will be glad to receive suggestions in the matter, which may be sent to the editor of this magazine. Two candidates for each office are nominated so that the members may have a choice, but this does not bind them to vote for either. Any member receiving a majority of the votes for an office will be declared elected, whether regularly nominated or not. It is well, however, to have your candidate regularly nominated, and to this end expressions of preference are invited.

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Vol. XVI No. 4

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A Quarterly Devoted to Ferns

Joliet, Ill.
Willard N. Clute & Company
1908

The Fern Bulletin

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THE GRASS-LIKE POLYPODY.—*Polypodium gramineum.*

THE FERN BULLETIN

Vol. XVI OCTOBER, 1908 No. 4

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NOTES ON SOME HYBRID FERNS.

By Margaret Slosson.

When the hybrid fern *Dryopteris cristata x marginalis* was first described, * it had been found only with a caudiciform rootstock, like that in *D. marginalis*, that is, a rootstock of upright growth, capped by a central crown. This character was supposed to be always dominant in the cross. It appeared in both of the two plants I obtained by artificially crossing *D. cristata* and *D. marginalis*, † which corresponded with the wild hybrid in all other respects as well.

Now, however, it is certain that a decumbent, creeping rootstock, like that in *D. cristata*, does sometimes occur in plants of this hybrid. It seems the exception, far from the rule, but I have seen it repeatedly in plants taken from different parts of a large swamp in Pittsford, Vt. In the plants that have it, the influence of *D. cristata* seems more marked than in those with the caudiciform rootstock: often the fertile leaf's pinnae appear farther apart and the leaf's apex is more abrupt, the leaf's general outline suggesting that in *D. cristata x spinulosa intermedia* (*D. Boottii*); the leaf's texture also, is perhaps slightly thinner, giving a slightly more lax appearance to the plant. But these differences are scarcely noticeable. It is possible, of course, that those plants with the creeping rootstock may be the result of a cross between *D. cristata x marginalis* and pure *D. cristata*, or that they may be offspring of *D. cristata*

* Bot. Gaz. 19: 497; 1894.

† See "Fernworth Papers," 24; 1900. Leaves from these plants are in the Herbarium of the New York Botanical Garden.

JAN 5 - 1909

x marginalis in which traits of *D. cristata* are re-appearing, but cannot be said to be probable, as it is doubtful if spores capable of germination are ever found on plants of *D. cristata x marginalis.*

An interesting feature of this hybrid is the half-evergreen character of its leaves. It stands, in this respect, midway between the parent species. The fertile leaves last more or less into the winter, not so late as those of *D. marginalis,* but long after those of *D. cristata* have withered.

D. clintoniana x marginalis was found by me in Pittsford some years ago, and has since been collected by others elsewhere. Its occurrence is noted in the latest edition of Gray's Manual. I believe no description of it has been published, and there is not space for one here, but, for the benefit of those looking for it, it may be said to resemble a large much over-grown *D. cristata x marginalis,* standing in much the same relation to that fern that *D. clintoniana* does to *D. cristata.* Specimens of it were shown with those of other hybrid ferns, by Mr. Ralph C. Benedict, at a meeting of the Torrey Club in New York last winter.

The study of hybridity in ferns promises to solve many problems presented by puzzling "finds" of collectors, and opens up a wide field for investigation, of absorbing interest.

The numbers of known American hybrid ferns is rapidly increasing. Of these the oldest and best known probably is *Asplenium ebenoides* Scott = *Asplenium platyneuron x Camptosorus rhizophyllus.* Several years ago, *Asplenium trichomanes x Belvisia ruta-muraria* described by Ascherson and Graebner in 1896, * was found for the first time in America, in Proctor, Vermont, by G. A. Woolson. † In the genus *Dryopteris*

* Synopsis der Mitteleuroparschen Flora, i: 79; 1896.

† See *Rhodora,* 8: 12; 1906. Also *Fern Bull.* 16: 46; 1908.

there are at least six ferns which intercross, namely, *D. cristata, D. clintoniana, D. goldieana, D. maginalis, D. spinulosa* and *D. spinulosa intermedia.* Mr. Benedict has pointed out that there are fifteen combinations possible here. Of these we already have the following: *D. cristata x marginalis,* Davenport; *D. cristata x spinulosa intermedia* Dowell * = *D. Boottii; D. clintoniana x goldieana* Dowell * = *D. goldieana celsa* Palmer; *D. clintoniana x marginalis, D. clintoniana x spinulosa intermedia,* Dowell; * *D. goldieana x marginalis,* Dowell *; *D. goldieana x spinulosa intermedia* Dowell *; and *D. marginalis x spinulosa* = *D. Pittsfordensis,* Slosson †; *D. cristata x spinulosa* is known to occur both in this country and in Europe. ‡ Four of the six remaining members, of the group were exhibited by Mr. Benedict at the meeting of the Torrey Club already mentioned, and will soon be published. This leaves two yet to be found. I confidently assume that they exist, and am convinced that collectors have only to look, to find, perhaps neglected in their own herbaria, both these and many other examples of hybridity in our native ferns.

Pittsford, Vt.

THE GRASS-LIKE POLYPODIUM.

Polypodium gramineum.

By Willard N. Clute.

In the popular mind finely-cut foliage and ferns are indissolubly connected. To such, the leaves of yarrow and columbine always have ferny characteristics and the adjective fern-like is always understood to refer to a much-divided leaf. The further one extends his knowledge, however, the less the word fern-like repre-

* Bull. Torrey Club, 35: 135; 1908.
† Rhodora, 6: 75; 1904.
‡ Bull. Torrey Club, 35: 135t 1908.

sents any definite mode of outline or cutting. In our own flora, simple and entire fronds are the exception, but if we search the world over we shall find that such species are not as rare as the study of our own flora may have led us to think; in fact, there are few genera without at least one or two of these simple-fronded species. In large works devoted to the ferns it is customary to arrange the species in the order of their cutting, the simple fronds coming first, then those that are pinnatifid, then pinnate and so on. Each group has much in common, and the species are more closely related among themselves than they are to the rest of the genus, but there are usually connecting links to join one group with another.

In the genus *Polypodium*, if we exclude the species usually placed in the section or genus *Phegopteris*, the fronds as a rule are not very extensively divided, nevertheless there are not a very large number with simple fronds. One of this number we have chosen for illustration. It derives its specific name *gramineum* or grass-like from the narrow fronds which are not unlike blades of grass in shape and size. It is most abundant in the elevated parts of Jamaica where it grows on the branches of trees often many feet from the ground. According to Jenman it may be distinguished from the species that resemble it by its horizontal root-stock, distinct stipes and median sori. Like so many of the *Polypodiums* its sori are somewhat oblong instead of round.

Owing to the fact that it grows on trees at a distance from the earth and depends upon the rains for its moisture it cannot grow in regions where rains are not abundant and comparatively frequent, though, like

several of its alies, its thick epidermis and scaly rootstock enable it to retain its moisture for a long while and endure considerable drouths unharmed. Ow illustration is natural size.

FERNS OF THE UPPER SUSQUEHANNA VALLEY.

By George T. Cleveland.

When Mr. Willard N. Clute published his "Ferns of the Upper Susquehanna Valley" he gave the least attention to the region extending from Binghamton, Broome County, to the true headquarters of the Susquehanna, surrounding Otsego Lake. This region comprises a strip of country approximately 170 miles in length, with a width of from one to thirty miles, including of course the watershed and smaller tributary streams. This region consists mainly of rolling hills having an average elevation of 1600 ft., reaching in a few places to nearly 3000. The country north of the Susquehana River itself is mainly composed of valleys and ranges of hills running in a north and south direction, while the southern side consists of two or three nearly parallel valleys running approximately east and west, namely the Ouleout, Charlotte and Schenevus creek valleys, divided by hills about 2500 ft. in height, lying in the southern half of Otsego County and the northern edge of Delaware.

The rock formation is of sandstone and shales belonging to the Oneonta, Ithaca and Catskill groups, the latter not reaching north of the river. This part of New York state shows the action of glacial ice as evidenced by numerous glacial lakes, striations, drift and a few traces of moraines. The summit of Rock Hill and Catamount Mountain, at Oneonta, and Mt. Inde-

pendence near Cherry Valley, appear however to have been above the ice and show distinct wave marks, as also do most of the hills along the valley of the Susquehanna, yet the hills to the south, of a higher elevation, are covered with glacial drift, some of which must have come from far to the north, as indicated by the kinds of rock composing it.

During the past three years I have covered the territory extending from Sidney, Delaware County, to Otsego Lake fairly well. While the fern flora is perhaps not particularly rich as a whole, yet in certain sections it is rather varied, as the following will illustrate. For lack of space the commoner species are passed over, and only those which are worthy of note are mentioned.

Camptosorus rhizophyllus, found in numerous rocky ravines throughout the section.

Asplenium ebeneum, Rock Hill and Catamount Mt., Oneonta, and at Franklin, Delaware County.

Nephrodium Spinulosum dilatatum, common on every heavily wooded hillside and on sides of wooded ravines.

Nephrodium Boottii, found in nearly every wooded swamp about Oneonta, and southward in the Ouleout Valley.

Nephrodium Goldieanum, two or three stations about North Franklin in the Ouleout Valley.

Nephrodium cristatum x Marginale, swamp near "Chinese Wall," Oneonta.

Cystopteris bulbifera. found in several ravines on the north side of the Susquehanna Valley, also throughout the Ouleout Valley.

Woodsia Ilvensis, a small station of exceedingly vigorous plants on the summit of a cliff on Rock Hill, Oneonta, elevation 1500 ft.; on the top of a dry shale

cliff on Catamount Mt., Oneonta, about 1600 ft. and extending for nearly three-quarters of a mile east and west. Thousands of plants but not particularly large, and exposed to the full blaze of the sun. Natty Bumpo's Cave and Prospect Rock, near shore of Otsego Lake; plentiful, large fine plants. Elevation 1800 feet.

Botrychium simplex, in rocky upland woods on the Mills Farm, North Franklin, Ouleout Valley.

B. lanceolatum, same station as *simplex.*

B. marticarifolium, one station in beech and maple woods Goodyear Lake, near Portlandville, Otsego County.

B. Obliquum, forms *dissectum, matricariae, Oncidense* and *intermedium,* in hilly pastures and along country roadsides; common.

Polystichum Braunii, in exceedingly deep and heavily wooden ravine on the south side of the Schenevus Creek opposite Chaseville. Otsego County. The rock formation of this particular ravine is curious in that it seems to be different from anything in the surronding territory. It is a shale almost approachinng to a gray slate. The sides of this gorge rise in places to a height of nearly 200 ft., making an angle of about 80° to the horizontal. About twenty-five or thirty plants of *P. Braunii* were observed growing at the base and on the shelves of this rocky wall. The rock is so weathered and shattered that it is impossible to scale the walls even for a short distance. The elevation of this gorge is from 1400 to 2000 ft.

This leaves the region north and east of Otsego Lake, which is on a point of the limestone ridge running through Central New York east to the Hudson, as yet unexplored.

OBSERVATIONS ON NEPHRODIUM SIMULATUM.

By J. C. Buchheister.

A piece of low woodland near Little Ferry, New Jersey, on the banks of the Hackensack River, on a perfect September day. All around the two *Woodwardias W. areolata* and *W. virginica* form a veritable sea. Interspersed, equally abundant, are *Nephrodium noveboracense* and *N. thelypteris,* with here and there some *Athyrium thelypteroides* and *Athyrium filix foemina,* the latter often forked and crested. At certain intervals arise fine plants of *Osmunda regalis,* and *O. cinnamomea,* with fronds often 5 feet long. There are hardly any flowering plants in this particular woods. The trees are mostly hickories and chestnuts, the underbrush *Clethra alnifolia.* But it is not any of these plants, on which my attention is riveted. Sitting on a tree stump, I gaze upon several sturdy plants of *Nephrodium simulatum,* which grow in a sort of "fairy ring" around a mouldering stump, which is mostly decayed, forming a little hillock of rich earth. The descriptions of the books are in my mind, but here I am making some observations of my own, in the field, face to face with the living plant.

The habit of this fern reminds me of nothing so much as it does of *N. cristatum.* There are the stiff erect fertile fronds standing up in the middle, while the sterile ones droop around them in lax manner. The latter have a much larger leaf surface, for fruit-bearing contracts the cells of a frond. *Nephrodium noveboracense* grows in a lax way, and. the habit of *N simulatum,* as it grows here, is so marked, that I would never confound it with the New York fern. In fact, this station was new to me, and my attention was at-

tracted quite from a distance by this habit, as above described. It has been said, that the pinnules do not seem to become revolute, as in *N. thelypteris*. They do! It is the rule here, indeed.

By the beginning of October the sterile fronds have become so limp, brownish, and generally ragged, that it is hard to find a good frond for the herbarium, but the fertile ones still stand upright, bright and green. As this interesting fern grows here, the fertile fronds resemble those of *N. thelypteris*. The pinnae are also drawn out in a rather long acute point. They could never be taken for the New York fern, not even by a beginner, if he is observant. But the sterile ones might. Is it possible that *N. simulatum* is a hybrid between *N. noveboracense* and *N. thelypteris*, as *N. Boottii* appears to be a hybrid between *N. cristatum* and a swamp form of *N. spinulosum?*

LYCOPODIUM LUCIDULUM POROPHILUM IN OHIO.

By Almon N. Rood.

I am sending you under separate enclosure a specimen of *Lycopodium* which I first found last season growing at Nelson Ledges, Portage Co., O. At that time only a single plant was discovered which Prof. C. C. Curtis of Columbia University pronounced *L. Selago*. As this is out of any reported range for *L. Selago*, I was naturally very anxious to re-establish my discovery and wrote to several friends who collect in this region to be on the lookout for it, giving them its probable locations. As a result my friend R. J. Webb, of Garrettsville, O., and Prof. L. S. Hopkins of Pittsburg, Pa., re-discovered it at my old station at Nelson

Ledges on Aug. 18th and on the 23d a friend of mine, F. N. Barber, of Crafton, Pa., and myself found it in considerable quantity growing at a place called Woodworths' Glen in Portage Co.

This *Lycopodium*, whether *"Selago"* or not, grows on the exposed face of conglomerate cliffs along the cracks or seams, seeming to prefer the upper and more inaccessable points of rocks where it flourishes, green and fruitful. However, our rocks are mere outcrops worn by streams or glacial ice and do not exceed 50 feet in height and our general altitude is not above 1000 feet. *L. Selago* has not, to my knowledge been reported from Ohio.

Phalanx, Ohio.

[As Mr. Rood suggests, the specimens sent were not specimens of *Lycopodium selago*, but of *L. lucidulum porophilum*. *L. Selago* is not found at low altitudes so far south. In passing it may be noted that the new "Gray's Manual" gives as the habitat "mountains and cold ravines." It is quite apparent, however, that this form is due to drouth rather than to cold or elevation and may be expected wherever the type is found on cliffs.—*Ed.*]

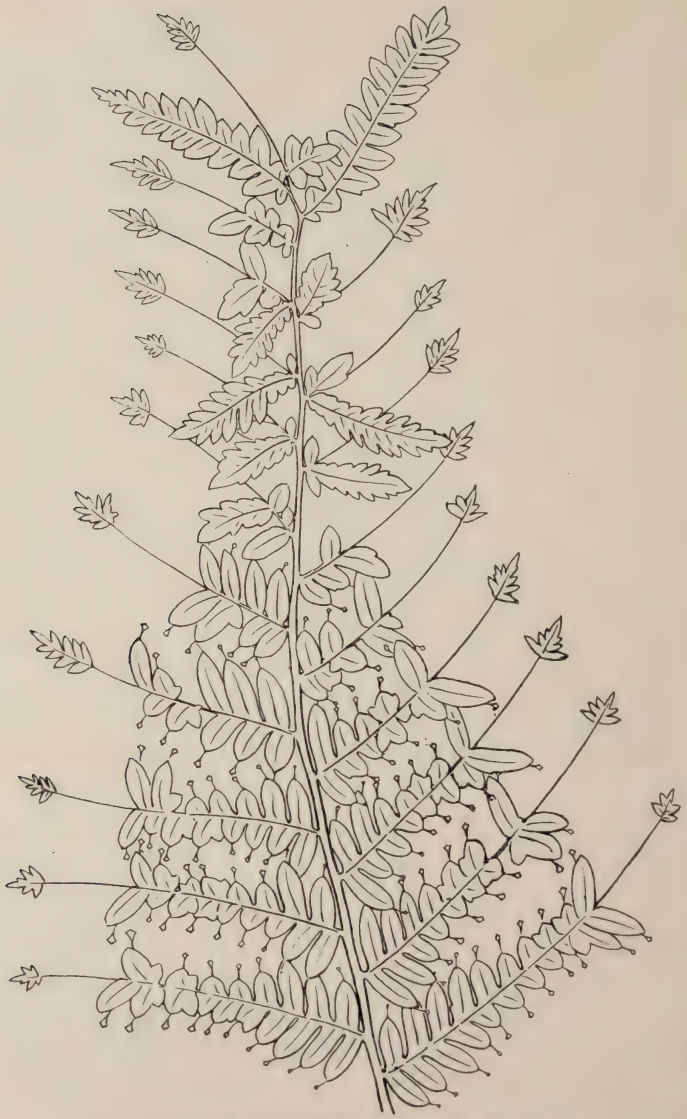
Woodsia Oregana—This species, though named for a State in the Far West is also recorded from Northern Michigan and Wisconsin. There seems to be no good reason why it should not be found further east and it was recently reported by Prof. M. L. Fernald as abundant in Rimouski Co., Quebec. Mr. Fernald suggests that it may yet be found in the higher elevations in Vermont.

RARE FORMS OF FERNS.—VIII.

An Abnormal Cinnamon Fern.

It was once thought, on this side of the water, that there must be something peculiar to the soil or climate of Great Britain that would account for the great variation in its fern species, but the longer we study our own ferns, the more certain it appears that fern variation in the old world is not so much a matter of soil and climate as it is of careful observation and search on the part of fern students themselves. Within a comparatively short time several variations from normal *Osmunda* plants have been recorded from America and it is quite likely that others will be noted in the future. In fact, to this lengthening list must now be added the form illustrated in the accompanying cut which was drawn from a frond collected by A. S. Bossart in a bog near Burton, Geauga Co. Ohio, in the early part of the summer of 1907.

A glance at the illustration will show that the new form is characterized by pinnae that are devoid of pinnules for some distance toward their tips leaving the slender mid-ribs as stalks supporting the apical cluster of pinnules. In a large number of pinnules toward the base of the frond a tendency is shown to repeat the outline of the pinnae, but a careful examination of the frond, itself, shows the terminal structures to be not mere expansions of green tissue but those more remarkable structures known as ascidia or pitchers. Ascidia are known on a great variety of flowering plants in some being the normal condition as in the pitcher-plants. In others, as in clover-leaves which sometimes assume this form, they are clearly abnormal. Some few ferns are known which normally form as-



OSMUNDA CINNAMOMEA F. CORNUCOPIAFOLIA

cidia but in the present case, this is, of course, a mere sport.

Another interesting feature in connection with our plant is the fact that the pitchers are not direct continuations of the main vein of the pinnule, but that they rise upon a separate veinlet given off by the main vein somewhere about the middle of the pinnule, and of course on the underside of the frond. Prof. L. S. Hopkins, to whom we are indebted for the drawing and notes concerning the plant, writes that when first discovered there were about twenty strong and vigorous plants of it growing under apparently normal conditions. During the present autumn the locality was visited again and additional plants of the form discovered.

Although this is recognized as being a mere abnormal form, it is quite likely that it can be propagated as a curiosity and since such forms are more easily discussed if given a name, it is suggested that it may be called *Osmunda cinnamomea* forma *cornucopiafolia*. From some observations made on half-fertile fronds of the cinnamon fern, it would appear that the cornucopias rise from the pinnules in much the same way as the sporangia do.—*W. N. C.*

DEATH OF ALVAH A. EATON.

Once more death has removed from our midst one to whom we have looked for many years as an authority in matters relating to ferns. Alvah A. Eaton died at his home in North Easton, Mass. Sept. 29, 1908. Mr. Eaton was among the most prominent of present day students of ferns, although but forty-three years old. He was the author of numerous papers on

Equisetum and *Isoetes,* described many species and forms in these groups, and revised the matter relating to them for "Gray's New Manual of Botany." Although the Pteridophytes were his favorites, he was also much interested in the flowering plants, especially the grasses and orchids and a grass has been named in his honor. For the past six years he has been connected with the Ames Botanical Laboratory at North Easton, Mass., and in the interests of this institution he made one trip to Europe and three collecting trips to Florida. On these latter he pushed his way into untrodden parts where he discovered more than a dozen ferns new to the United States.

Mr. Eaton was born at Seabrook, N. H., Nov. 20 1865. When he was twelve years old his family moved to Salisbury, Mass., where the rest of his boyhood was spent and where he became familiar with the cultivation of plants which stood him in good stead later in life when failing health led him to take up the business of florist and gardener for a time. He was graduated from the Putnam School at Newburyport, taking the four years course in two years. He then taught school in Seabrook one year and in California three years. Returning to the east he again took up teaching for some years until he turned florist.

Like many of our most enthusiastic botanists, Mr. Eaton was entirely self-taught, but his work was none the less thorough on that account. He early became a member of the Linnaean Fern Chapter, now the American Fern Society, and was a contributor to the *Fern Bulletin* almost from the beginning. The bulk of his scientific writings have appeared in this journal and in the miscellaneous publications of the Fern Society.

He has also published more or less in *Torrey Bulletin* and *Rhodora.*

Mr. Eaton was for two years Secretary of the American Fern Society and President for one year, refusing a re-election to the latter office on account of a pressure of other matters. Later he took up the formation of an herbarium for the Society. He was appointed the first curator and retained this office until his death. The Herbarium now numbers more than one thousand sheets being particularly rich in rare and unusual forms of ferns. The mounting is the work of the curator. A portrait of Mr. Eaton was published in the tenth volume of *The Fern Bulletin.*—W. N. C.

ASPLENIUM EBENOIDES IN NEW YORK.

By Stewart H. Burnham.

My attention was called to a very fine plant of Scott's Spleenwort (*Asplenium ebenoides*), October 14, 1905; when visiting Miss Hattie T. Burnham. Miss Burnham had found what she considered to be a peculiar fern, in July of that year, in a limestone pocket, in company with *Asplenium platyneuron* and *Camptosorus rhizophyllus,* in the northwestern part of the town of Hartford, Washington County, N. Y., and had transferred the plant to a flower pot where it was growing finely. A more careful search was made about the rocks in the neighborhood of the station, but no other plants were found. However, several hundred rods away, a station for the uncommon *Asplenium platyneuron incisum* (E. C. Howe) Robins. was found. In August 1906 the plant had grown so well that it was divided, Miss Burnham keeping part of the plant which has not grown so luxuriantly as the other portion of the plant which came into my possession at that time.

In its general appearance the plant shows more of the characters of the ebony spleenwort; except in the tapering and rooting fronds which are like the walking-fern. My original plant is growing in a medium-sized plant jar and ten of the eleven fronds are heavily fruited. Seven of these fronds are over 12 inches long: and three or four of them 20 inches long by 4½ inches broad. The tips of five of the fronds are forked: the forks being linear and from 2 to 4 inches long, making the extreme length of one frond 2 feet. From the forks proliferous plants have been produced; and in several instances the pinnatifid pinnae have also produced individual plants, which would root if they were brought in contact with the soil. During the spring of 1908, three of the proliferous fronds were placed in the earth of a side jar and have grown well, producing plants with eight or nine fronds similar to those of the original plant. These side plants, November 22, had fronds that were beginning to fork at the tips and two of the fronds had begun to fruit. Very evidently the plant has the mode of propagation of the Walking-fern: and if proper care is taken of it, will within a few years form a mat of considerable extent. The plants in the side jar have not severed their connection with the main plant; although they probably will in time, for there is some discoloration of the parent fronds.

The habitat of this hybrid fern is very similar to the station at Proctor, Vt., noted by G. A. Woolson in *Fern Bull.* 9:89-90, Oct. 1901 and in *Rhodora* 3:248-249, Oct. 1901, where the fern was found growing in a limestone pocket with the two parent species. The station for G. H. Ross's Rutland, Vt. plant, which is deposited in the herbarium of University of Vermont, cannot be over thirty miles distant from the Hartford

station in New York. The only other record of this rare fern in New York State is in the N. Y. State Mus. Rep't 36:36. 1884; from near Saugerties, Ulster County and also four miles southeast of Poughkeepsie where it was found by C. Lown. Specimens of the Saugerties plant are found in the State Herbarium at Albany.

Geological Hall, Albany, N. Y.

NOTES ON EQUISETUM HYEMALE

By Chas. C. Plitt.

I. Spore Shedding.

When does *Equisetum hyemale* shed its spores? The following notes upon observations will throw some light upon this subject. They cover a period of three or four years and were made, as opportunity offered, upon plants in various locations. For convenience they have been arranged as if they were all made in the same year. Little inconsistencies arising are due to the inequalities of the season, some seasons are so much ahead of others.

Mar. 18. Today found spore cases on the old stalks of *Equisetum hyemale* swelling.

April 17. Found plants of *Equisetum hyemale* shedding spores. The weather has been quite pleasant for several days.

April 26. Spore cases are swollen and some are shedding spores. It would seem that with the approach of warm weather in spring, growth takes place and the spore cases become several times their size during winter. The white bands on this plant show out beautifully today.

April 29. Spore cases are shedding spores. In

some localities not so far advanced as in others.

May 10. New stalks of *Equisetum hyemale* are coming up, and I had a chance of seeing the blackish teeth. Already the most of them have fallen off, although the stalks are scarcely out of the ground and are but a few inches in height.

June 1. Young shoots of *Equisetum hyemale* still appearing. Old stalks that have fruited are branching near the top.

July 1. Young shoots of *Equisetum hyemale* are shedding spores.

July 13. Young shoots of *Equisetum hyemale* still shedding spores.

From the above records, although rather incomplete, I am led to believe that *Equisetum hyemale* has a prolonged fruiting period, occurring most abundantly in the early part of July, when it covers a period of about two weeks, and continuing until cold weather.

However, after the middle of July, spore-shedding specimens are certainly less frequently seem, (I have no record of seeing any), although fertile spikes are continually being produced(?). It would seem that most of these late-formed fertile shoots, do not fully mature, for some reason or other. At any rate, they persist through the winter in tightly-closed spore-cases, and await the warm days of spring. Then, already in the latter part of March, there is a noticeable increase in size of these old late-formed spore-cases, and during the latter part of April, covering a period of about two weeks, there is again a shedding of spores, this time from these late-formed cases. The beginning and length of these two fruiting periods vary with the locality. In some localities, especially those in shady woods, this *Equisetum* is seldom, if ever found in fruit;

but, in the sunny places, along roadsides, and along the river-banks, fruited specimens may be found in great abundance.

II. Production of Roots and Shoots.

When stalks of *Equisetum hyemale* are put into water, small papillae show themselves in five days on the lowest node. Two days later they have appeared also on the node, next above. These little papillae have been produced by new shoots penetrating the tissues, and which, a few days later grow out into the air. These shoots grow out from the nodes only, not only from those in water, but also from those above. None ever appear at the injured end. The shoots are true stems, and grow upward into the light; from the lower end of the shoots roots appear which grow downward into the water. Whether the base of the stalk or its apex be placed in water, the results are practically the same.

As cuttings rooted so well in water, and which later could be transplanted into soil and grow, I tried rooting them in soil direct. On April 10, planted 8 cuttings upright in soil and then placed two flat on the ground, covering them only, here and there, lightly with soil. On June 30, visited the spot again, and found 7 of the upright specimens rooted and growing, also one of the specimens that had been lying on the ground.

Cuttings taken from very young stems, while yet of that light green color, do not root at all, only those taken from mature stems will do so, and that too, at all seasons, whether winter or summer, spring or autumn.

It is interesting that cuttings will root whether placed upright, with base in water, or inverted. Stems

of willow will do the same, but with this difference. In the willow we find that roots are produced from the nodes on the portion of stem in water, and leaf-bearing stems from those nodes out of the water, and that, too, no matter whether the base of the cutting or its apex, be placed in water. With *Equisetum hyemale,* all the shoots produced are stems, roots appearing later from the base of each newly formed shoot.

The shoot, when it is first produced, grows very slowly, so slowly, that the roots, although formed later, soon grow quite beyond it. For a little while the stem is apparently at a standstill. But, after the new roots have made a little growth and are absorbing nourishment, the little stems begin to shoot upward quite rapidly. More shoots, on the average, are produced from the lowermost nodes, that is the nodes in or nearest the water, no matter whether it is the base of the stem or its apex which is in the water. We notice also, that growth here is more marked—it is here that the shoots are the strongest, these, too, show strongest root-growth and later the more rapid growth of the stem.

It is interesting, too, to note, that the papillae showing where shoots are about to penetrate the stem, do not continue upward farther than the fourth node, in most cases to the third node only, and that after the third or fourth day after the appearance of the papillae, all that are likely to be formed, have been formed, so that on the fifteenth day of the experiment, there are no more shoots than on the ninth. It seems, too, that three shoots are the greatest number of shoots, from any one node.

Baltimore, Md.

Botrychium lunaria.—This species was omitted from the California Fern Flora, published in the first number of volume twelve (1904) of the *Fern Bulletin*, as no reliable evidence of its presence in the state could be obtained, although it had been reported. It may now be added, as I have received authentic specimens, collected near Mariposa, by Mr. J. W. Congdon.—*S B. Parish.*

Slender Cliff-brake in Japan.—The Flora of Japan is very much like that of Eastern America, and many of the ferns are common to the two countries. A list of Japanese ferns would contain *Osmunda regalis, O. Cinnamomea Asplenium trichomanes, A. viride Pteris aquilina, Botrychium ternatum* and many more whose names are familiar to us. Last to be added to the list is the slender cliff-brake (*Cryptogramme Stelleri* or *Pellaea gracilis*),which was discovered recently on Mt. Yatsugatake in the province of Shinano, by T. Makino.

Lomaria Spicant's Variable Sporelings.—That so many variants should have arisen from a sowing of *contractum* mentioned recently is of particular interest inasmuch as they apparently embrace exact counterparts of two British forms, *concinnum* and *lineare*, and also of another section altogether viz: *multifurcatum*. It is, however, not quite clear from text and illustration whether all the forms figured were raised from *contractum* or whether the English types are introduced to show approximation. I am strongly of the opinion that this latter is the case. Apart from these

the variable extent which the contracted part assumes is to be expected in sporelings from the *contractum* type. I have found *contractum* repeatedly here, but *concinnum* only once. *Concinnum Drueryi*, in which the lobes are round and markedly serrate, like scallop shells, is so far unique. Finally in this connection, why *Lomaria? Blechnum* is differentiated from *Lomaria* by possessing an independent intramarginal indusium instead of the reflexed margin itself, serving this purpose. The distinction is so marked that it is a puzzle how any botanist can ignore it. It is perfectly clear as *Blechnum spicant* and it is due to this that such a form as is described by your contributor with sori in short strips on each side of the rachis on otherwise undifferentiated fronds is possible. The form occurs here wild and is termed *B. s. anomalum*. Lomaria could not do this without sacrificing its generic character.—*Chas. T. Druery, F. L. S., London.* [Mr. Druery apparently overlooks the fact that there is such a thing as a difference of opinion. Fern students have never agreed as to the disposition of the fern in question. Both Link and Desvaux considered this a *Lomaria*, and many others since their day have done so. But in return for Mr. Druery's "Why *Lomaria?*" we can retort with equal vigor, "Why *Blechnum?*" Surely Mr. Druery must know that the modern world now calls this plant *Struthiopteris spicant*. In any case, however, we are surprised to find anyone objecting to *Lomaria* while still clinging to the out-of-date and discredited *Lastrea* in place of *Nephrodium*. If Mr. Druery will promise never to use *Lastrea* again we will agree hereafter to bluepencil all references to *Lomaria*.—Ed.]

SOME CURIOUS NOMENCLATURE.—In Gray's "New Manual of Botany" a form of Goldies fern found in the Dismal Swamp some time ago by William Palmer is listed as *Aspidium Goldieanum* var *celsum* (Palmer) Robinson. The excuse for attaching the last name to the author-citation is difficult to discover. Several years ago the combination of *Aspidium Goldieanum* FORMA *celsum* was made by another author and the only reason, if reason there be, for attaching the second name to this string of latin words is that the word variety is used instead of form. There is absolutely no exact botanical definition of either form or variety extant. Either one may represent any grade of variation less than a species, in fact the two words are practically synonymous, and instances are plentiful in the volume cited where variety is used for a mere ecological form and form for a well-marked subdivision of a species. The only difference between the two conceptions that we can see, is that one should always use variety if it will get one's name into the combination.

BOTYRYCHIUM DICHRONUM.—In an article dealing with the Ophioglossaceae in the May *Torreya*, R. C. Benedict continues the error made by L. M. Underwood in reference to the Jamaican form of *Botrychium Virginianum*. Relying upon the fact that the sterile portion of this plant survives the winter in the mild climate of that tropical island, Underwood made it a distinct species. Jenman, whose work on the Jamaican ferns was most painstaking, overlooked a most important fact in the life history of this plant and writes of it "There are two fronds to each plant, one without and the other with the fertile division. * * * the fronds perish after fruiting." It remained for the editor of

the *Fern Bulletin* to point out that Jenman was mistaken in supposing that the fronds perish after fruiting and that what appears to be a second sterile frond is in reality the old fruiting one of the year before from which the fertile part has dropped. Thus reduced to facts, the basis for making *B. dichronum* a species is that it survives the winter in the tropics. We shall ever maintain that species should differ from one another in important particulars and not be separated upon differences of latitude and temperature in their habits. Having seen the plant in question in its native woods, we are confident that it does not deserve even varietal rank.

Changes in Fern Names.—In a paper published in *Torreya* shortly before his death, Dr. Underwood called attention to some overlooked names for American ferns, which the appearance of Christiansen's "Index" has made apparent. All but one of these have been noted in the check-list of fernworts now being published in this magazine, but it may be well to bring them together here. If we follow Christiansen we shall have *Ceratopteris pteriodes* (Hook) in place of the well-known *C. thalictroides* (L), and *Polypodium glycerrhiza* D. C. Eaton for *P. falcatum* or the more recent *P. occidentale* applied to the liquorice fern of the Northwest. Owing to a confusion of references to old plates we are asked to use *Pteris multifida* Poir in place of *Pteris serrulata*. L. f., although all authors confess that there is no other *P. serrulata* and even the original home of the plant which has been called *serrulata* is unknown. If we follow Christiansen we will also write *Pellaea mucronata* D. C. Eaton in place of *P. Wrightiana* Hook, and *P. scabra* Christiansen in place of *P.*

aspera Baker. Two *Aspleniums* also are in danger, the name of *A. abscissum* Willd. endeavoring to supplant *A. firmum* and *A. cristatum* Lam. endangering the well-known *A. cicutarium.*

Fall-fruiting of Osmunda.—Mr. J. C. Buchheister writes that during the past dry autumn he found in the Hackensack meadows a plant of the royal fern (*Osmunda regalis*) that was fruiting for the second time. Almost every frond bore fruit and there were ample remains of the spring fruiting fronds. The plant did not appear to have been injured in any way and the reason for the second crop of fruit is not apparent.

Ferns of Ohio.—There are various ways of making a fern list and each has its advantages from an educational standpoint. The fern floras of the States while giving a survey of the whole fern-flora fail to convey an adequate idea of the way in which the ferns are associated or the habitats they prefer. Prof. L. S. Hopkins has sent us a list of Ohio ferns catalogued in another way. Those who have the ferns of their own locality well in hand may find it interesting to list them in the new way. Of the 61 ferns and fern allies in Ohio, 29 species are evergreen. Catalogued according to the habitat we have 10 that grow in marshes with or without shade, 24 that grow in rich woods and thickets, 13 that grow on rocks, and 3 that grow on nearly pure sand. In addition to these there are 10 that grow in several habitats, among which may be numbered the bracken, marsh fern, sensitive fern, and others. If desirable the divisions could be made still finer, as for instance those that prefer open swamps,

those that prefer shaded swamps, species of dry woods, wet woods, on sandstones and shales, on limetones, in sand, in clay, in alluvial soil, in stony soil. The soil usually has considerable to do in determining the kinds of ferns growing in a certain locality. Some ferns can grow in several different soils but others seem confined to a single one.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omission from, this list.

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Bessey, C. E. *The Families of Fern-like Plants.* Fern Bulletin, Jl. 1908.

Bourn, A. *The Botrychiums of Dorset, Vermont.* Bulletin of Vermont Botanical Club. Ap. 1908.

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Clute, W. N. *Checklist of North American Fern-worts.* Fern Bulletin. O. 1907.—A continuation completing the list of ferns.

Clute, W. N. *Changes in Fern Names.* Fern Bulletin, O. 1907.

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Greene, F. C. *Ferns of Bloomington, Indiana.* Fern Bulletin, Jl. 1908.

Kirk, G. L. *New Stations for Ferns in Vermont.* Rhodora, O. 1908.

Jewell, H. W. *Polypodium Vulgare auritum.* Fern Bulletin, Jl. 1908.

Jones, M. E. *Fern Genera.* Fern Bulletin, Jl. 1908.

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Scoullar, Mrs. A. E. *Fruiting of Botrychium.* Fern Bulletin, Jl. 1908.—A record of the behavior of individual plants of *B. Matricariaefolium, B. obliquum* and *B. o. dissectum* for successive seasons.

Winslow, E. J. *Polystichum acrostichoides var. incisum interpreted.* illust. Fern Bulletin, O. 1907.—A form of *Polystichum acrostichoides* bearing much enlarged and pinnate pinnae figured.

EDITORIAL.

The long-expected title-pages and indices to the past four volumes of this magazine are ready for the printer but cannot be sent out with this issue because two numbers are to be mailed in one wrapper and it would make the package too bulky. The indices will be issued at once and sent to all the libraries on our lists as well as to all others who have asked for them. If there are others among our readers who need these indices we shall be glad to send them free upon request.

* * *

A few months ago, we had occasion to warn our subscribers against sending money to us in the mails since there was a leak, somewhere, that absorbed a great deal of the cash which should come to us. Those who lost money in this way may be interested in hearing that investigation by the secret service showed that the mail-carrier on our city route was the guilty party. He has ceased to be connected with the postal service but will continue to work for the government, having already been provided with a nice striped suit and a guarantee of three rather plain meals a day for some time to come. It is to be regretted that our country has not, as yet, devised a very safe and convenient means of transmitting money by mail. The best way to send is by an express money order or bank-draft. Those who have an account with any bank can usually obtain drafts on a bank in New York or Chicago without paying a fee. Checks drawn upon banks in New York, Boston or Chicago are also usually accepted at face value and can be cashed only by the person to whom it is payable or to his order. Registered letters

and postal money orders are issued for a small fee and some of these methods are much better than to trust stamps or bills in a letter.

* * *

So far as we are aware, there are but two societies for the study of ferns in the entire world. The American Fern Society has a world-wide membership, but the second society is confined to Great Britain and Ireland and is known as the British Pteridological Society. The latter has been in existence about as long as the American Society, but has a much smaller membership and issues no publications, save an annual report which contains rather more about ferns, however than the annual reports of the American Fern Society Recently the British society has apparently concluded that the time has come for a more extended propaganda of their cult and under the leadership of Mr. C. T. Druery, a member of the American Fern Society and well-known on this side as a writer on ferns, are considering the establishment of a serial publication. Upon our part we view with pleasure this move for advancing British fern study and have no doubt that Mr. Druery and his association will be able to make a most readable journal and one that would secure not a few subscribers in this part of the world. We trust that the scheme may be carried out.

* * *

It may be news to many fern students that there is a series of publications on ferns and related matters in addition to the issues of the *Fern Bulletin*, but such a series exists. We refer of course to the annual reports of the American Fern Society, which taken in connection with the three special publications entitled "Papers

Presented at the Boston Meeting," "Fernwort Papers," and "An Index to the first 10 volumes of the *Fern Bulletin*" form a body of considerable size. The first paper contains 32 pages, the second 48 and the third 32. The first three Annual Reports were published in this magazine, but the others, ranging from 8 to 20 pages were issued separately. These contain a good deal of matter of more than passing interest and are beginning to be in demand by people not members of the American Fern Society. Such odd numbers of the Annual Reports as have accumulated at this office have recently been made up into sets and a set will be sent for 10c until the supply is exhausted. The best set contains a complete set of the Reports, a history of the Fern Chapter, Constitution of the Society, and various papers relating to the meetings of fern students. The three special papers, of course, are not in this collection but they may be purchased separately at a price that is small considering their value.

* * *

Every little while some kindly disposed subscriber writes to tell the editor how to run the magazine, and when the editor, mindful of past failures and successes declines to depart from the course which he knows is the best, said kindly disposed subscriber is kindly disposed no longer. Indeed, he is quite likely to cancel his subscription and write forthwith to his friends, proposing to establish a new fern publication that shall simply wipe this magazine and its editor off the map. Sometimes it is a matter of nomenclature that excites the subscriber's ire; again it is the exasperating way the editor has of interpreting species to suit himself, or his failure to be impressed by long descriptions of small differences in big words. Some have seriously pro-

posed that the magazine adopt a standard of nomenclature and allow contributors to contribute in no other. This interesting method of binding and gagging the opposition has never appealed very strongly to us, perhaps because we have a very decided objection to being made the victim of such proceedings ourselves. The editor believes in everybody having his say, and has never yet refused to print an article because it attacked him or his opinions. He continues to have opinions every little while just the same, and when he does he is quite likely to express them. The ideal editor in the minds of many who have axes to grind is that he should be a sort of combined proof-reader and office boy, and not meddle with the contents of his publication; but we think otherwise. We must emphasize the fact, however, that the columns of this magazine are open to anybody anywhere to say what he pleases on fern matters, so long as his remarks will pass through the mails unchallenged. He may use any brand of nomenclature he likes—antiquated, international, or New York local; he may be as conservative as a Chinaman or as radical as the worst of the "I-saw-it-first" school; he may describe genera as species or forms as genera—in short, we shall place no restrictions on the nature of contributions, so long as we are not asked to subscribe to them or forget that we have a mind of our own.

Just here we picked up an editorial in the *Independent* that expresses our position so much better than we can do it ourselves that we quote as follows: "We have an idea of what such a journal as this ought to be. It is not a bunch of posies nor even a bundle of herbs or a package of candy. Its purpose is not to be sweet and please everybody. What is it in a journal that holds the affection of its readers, that makes them take it

year after year? It is not its miscellaneous stories and things that are as timely a hundred years hence as now. To our notion an intelligent reader wants to find something that has force; something that he is inclined to either clasp or kick. A journal secures real lovers only as it presents a definite and strong editorial policy which, on the whole, commends itself to them."

AMERICAN FERN SOCIETY

The Annual Election in October resulted in the election of Prof. E. J. Winslow of Elmira, N. Y., as president and the re-election of Miss Mirick as treasurer. The vote for vice-president resulted in a tie and the vote for secretary is still being canvassed by the advisory council. This issue of the *Fern Bulletin* has been held for some time in the hope of announcing the complete list of officers, but further delay seems unadvisable. The result will be announced in the January number.

For some unexplained reason, no Annual Report for 1907 has been issued and in consequence the list of members contains many inaccuracies. It is to be hoped that the regular report will soon be issued and that members will promptly notify the officers of any change in address. Since the annual dues must soon be forthcoming it is suggested that members notify the treasurer of such changes when sending in dues.

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